VOLUME 37
NUMBER 8

AUGUST, 1950

plating

CREATING MODERN SILVERWARE II

See Contents Page 827

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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 610.

Ne[illegible]reations

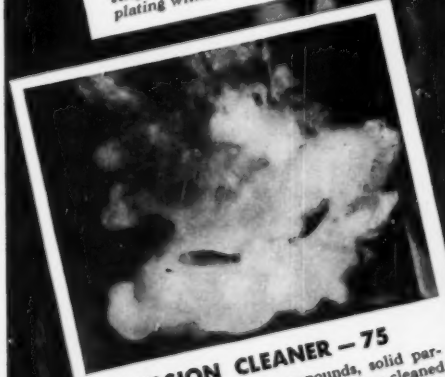
[illegible]AL FINISHING . . .

METAL STRIPPER — A

An outstanding development for stripping defective electroplated nickel, copper, silver, cadmium and zinc from steel. Fast action . . . no basis metal attack. The highly polished grill cover illustrated has been completely stripped of nickelplate, and is ready for replating without repolishing.

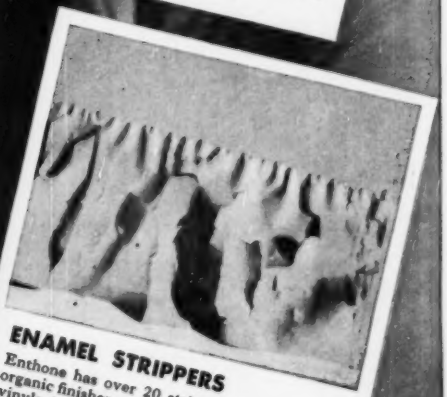
EBONOL BLACKENING PROCESSES

Ebonol finishes are used to beautify a widely diversified list of superior quality products. Photo shows steel parts blackened with Ebonol-S and S-30; copper and brass with Ebonol-C; zinc with Ebonol-Z. U. S. Patents — 2,364,993, 2,460,896, 2,460,898.



EMULSION CLEANER — 75

Oils, greases, buffing compounds, solid particles, deep seated in steel parts are cleaned out and completely removed by this emulsification process. Stubborn, gummy substances on die castings, milling machines, floors, motor blocks emulsify and disperse in water instantly.



ENAMEL STRIPPERS

Enthone has over 20 strippers for removing organic finishes — synthetic enamels, lacquers, vinyls, japans. The best strippers, tailor-made for your particular problem, are selected by laboratory technicians after test runs. This service is rendered free of charge.

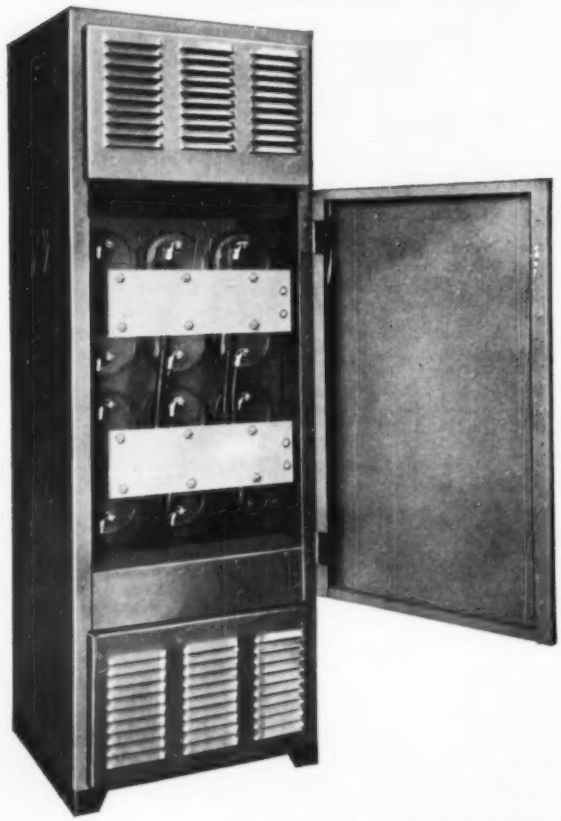
[illegible] with dips by step [illegible] Enthone Products with [illegible] tion upon request.

Enthone Incorporated

[illegible] ELM STREET [illegible] HAVEN [illegible]

NEW-General Electric Plating Rectifier with Oil-immersed Stacks

The first plating rectifier with selenium stacks completely protected from corrosive atmospheres



Here's a plating rectifier you can put right next to your plating tank without worrying about corrosion of the stacks.

Now you can have the time-saving advantage of tank-side location and cut electrical losses with short connections—yet still get full life from your rectifier stacks.

Only General Electric offers you such a rectifier. Only G.E. has an oil-immersed selenium rectifier stack designed specifically for plating work.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 612.

it's ideal for barrel plating

With a new and improved type of ventilation, and with the ample thermal capacity of the oil in the hermetically sealed can, this new plating rectifier can carry the short-time overloads without overheating. The normal cycle of barrel plating operations subjects a rectifier to wide voltage variations between no-load and full-load conditions. But this new G-E plating rectifier is designed to take these voltage fluctuations safely.

★

This new General Electric oil-immersed selenium plating rectifier is a rectifier you will be hearing about wherever plating is discussed. Get the complete details. Write to Section 464-2, Apparatus Department, General Electric Co., Schenectady 5, N. Y.

Here are some Features

Oil-immersed Selenium Stacks. Hermetically sealed in welded, oil-filled cans, the rectifier stacks are completely protected from plating-room atmosphere. No acid fumes can reach the stacks. Maintenance costs are reduced to a minimum.

Ventilation. The ventilating fan is mounted in the top of the unit—blowing air downward, directly over the rectifier units and then over the transformer. Special baffles direct air so that ventilation is not disrupted when the inspection door is opened.

Dual Output Rating. By a simple bus-bar connection, you can connect the rectifiers in series or parallel. For example, you can get 6 volts-1500 amps or 12 volts-750 amps from the same rectifier.

Dual Input Rating. This unit can be connected in delta to operate from 230 volt circuits or in wye from 460 volts. Taps are provided to correct for line-voltage variations.

Casing Design. When the inspection door is open, steel baffles protect the operator from high-voltage connections. For easy maintenance, all parts are removable from front and rear panels. To complete the corrosion resistance of this unit, all casing parts are phosphatized, then sprayed with acid-resisting hammertone gray lacquer.

2 models—8 ratings

6/12 volts dc—1500/750 amps	230 or 460 volts ac 60 cycles—3 phase
9/18 volts dc—1500/750 amps	230 or 460 volts ac 60 cycles—3 phase

Higher ratings may be obtained by combining units in series, parallel, or both.

GENERAL ELECTRIC

464-2

Briefs on barrel finishing

Technical Service Department
WYANDOTTE CHEMICALS CORPORATION

Summary: *Barrel finishing offers manufacturers an economical method of finishing small parts in bulk. Steel balls or shapes produce a smooth lustrous finish. Stones remove excess metal, as well. Improvements in technique are widening the field.*

Barrel finishing consists of rotating the work in a barrel together with a burnishing medium and a solution of the burnishing compound. The parts are handled in large quantities and the labor cost per part is low.

The method is especially suited to very small parts. The work is easier to clean than buffed work. It is possible to form definite radii and micro-inch surface finishes. It can produce mirror finishes.

Two media are used: steel balls or stones. Steel balls are used to produce a smooth lustrous finish. They remove almost no metal. Rather, they "iron out" the surface by the rolling and sliding burnishing shapes. Stones, on the other hand, remove excess metal in addition to producing a smooth finish.

The burnishing compound serves as a lubricant between the parts and the burnishing medium and between the parts themselves. In this manner, a smooth finish is obtained, whereas, in its absence, seizure and scratching are easily possible.

Often, the burnishing compound contains a brightening agent to remove metal oxides and yield a true metallic color. Lastly, the burnishing compound should have sufficient detergent action to remove traces of oil and other contaminants from the parts.

The burnishing compound should be selected with care. It should suit both the work and the media. Wyandotte products for this use include: Light Alloy No. 1 Cleaner, Burnishing Compounds 317, 321 and 322, Burnishing Powder and Neosuds*.

By far the greater percentage of small parts can be finished in a barrel with few problems. As the parts become larger and more complex the difficulties do increase. But with ingenuity more and more types of work now considered too difficult or uneconomical will yield to improved techniques of barrel finishing. If you have a problem write us.

*Reg. U. S. Pat. Off.

THE WYANDOTTE LINE – products for burnishing and burring, vat, electro, steam gun, washing machine and emulsion cleaning (soak or washing machine), acid pickling, related surface treatments and spray booth compounds. An all-purpose floor absorbent: Zorball – in fact, specialized products for every cleaning need.

WYANDOTTE CHEMICALS CORPORATION
WYANDOTTE, MICHIGAN
SERVICE REPRESENTATIVES IN 88 CITIES

Wyandotte
REG. U. S. PAT. OFF.

Industry News

Plating Class in Philadelphia. The Educational Committee of the Philadelphia Branch of the American Electroplaters' Society has made arrangements with Temple Community College and Technical Institute, 18th and Buttonwood Streets, to hold a course in Practical Electroplating this fall, beginning September 25.

The purpose of the 14-week semester course is to provide electroplaters with a sound understanding of the principles underlying their practices.

It will be taught by Dr. Samuel Heiman, Chief Chemist of Philadelphia Rust Proof Company and President of the Philadelphia Branch. One evening a week, he will lecture for one hour on operating characteristics, purification, and control of various plating solutions and then supervise two hours of laboratory work on analysis of solutions and testing of deposit.

The fee will be $24.00 per semester, which is the standard Temple fee. There will be no separate laboratory fees.

The course, which will be approved for veterans under the G. I. Education Program, will count toward a Certificate of Proficiency issued by Temple University.

The Industrial Chemical & Equipment Company, Minneapolis, Minn., representatives of many leading manufacturers of polishing, degreasing, and electroplating equipment and supplies, has moved to new quarters at 205 11th Avenue South, Minneapolis 15. The new location affords increased space for offices, warehouse, and customers' service laboratory.

R. W. Renton and Company, with facilities in Cleveland and Indianapolis, has recently completed arrangements with **United Chromium, Incorporated** for the application of Unichrome Plastisol and air-drying rack coatings. Already well known in the Ohio and Indiana area, Renton now offers the added service of coating racks with the Plastisol Unichrome Coating 218X. With 16,000 square feet of space in its Cleveland plant, the company is equipped to handle large jobs.

The Pacific Chemical Plant of the American-Marietta Company of Los Angeles, Calif., has been purchased by **Wyandotte Chemicals Corporation.** Wyandotte will immediately revamp the property to provide a Pacific Coast manufacturing unit to serve Wyandotte

Published monthly at 5800 N. Marvine St., Philadelphia 41, Pa. Entered as second class matter July 1, 1946, at the Post Office at Philadelphia, Pa., under Act of August 24, 1916. Copyright, 1950, by the American Electroplaters' Society, Inc. Subscriptions: Domestic and Canada, $4.00 per year, 50c per copy; Foreign, $6.00 per year, 75c per copy.

FREE . . . *NEW* FEDERATED ANODES CATALOG!

This new Federated ANODES catalog is full of facts that every man in the plating business should know.

Emphasizes usable data on M-Sterling Chill-formed copper anodes, and those of zinc, tin, brass and cadmium. Anodes are listed in full detail as to size of body, length of hooks, position of markings and other essentials. Drawings indicate shapes, dimensions, styles of ribs and cores.

To get copies of this anode catalog, or to fill any of your plating needs, call or write any one of Federated's 25 sales offices across the nation.

Federated Metals Division

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SPRAY BUFFING COMPOUNDS

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This buffing *ENGINEERING* service is available to you
TRY IT! BUY IT!

J.J. SIEFEN CO.
5641 LAUDERDALE • DETROIT 9, MICH.
Nationwide polishing and buffing service

Industry News

branches which have functioned for a number of years in Los Angeles, San Francisco and Seattle.

Pacific Chemical's plant and sales personnel will be absorbed by Wyandotte's Pacific Division, and the Wyandotte research and technical-service staffs, numbering nearly 200 persons, will become available to users of Pacific Chemical products, as well as to companies using Wyandotte products.

The Blackburn Specialty Company, Cleveland, Ohio has changed its name to **Blaco Manufacturing Company,** and products manufactured will be sold under the new trade name Blaco. There are no changes in management personnel.

Instrument Courses. Brown Instrument division of Minneapolis-Honeywell Regulator Company will open its second half of 1950 maintenance and repair courses on August 14. "The courses will again be fitted to the specific requirements of customers who will send employees to the Brown School", said M. J. Ladden, chief instructor. "Classes will be held on a three-, five- and 13-week basis. The shorter courses will be for concentrated product instruction, the longer courses for more comprehensive training in complete industrial instrumentation".

All classes will be conducted at the company school in Philadelphia. Inquiries should be directed to Brown Instruments Division, Minneapolis-Honeywell Regulator Company, Wayne and Roberts Avenues, Philadelphia 44, Pa.

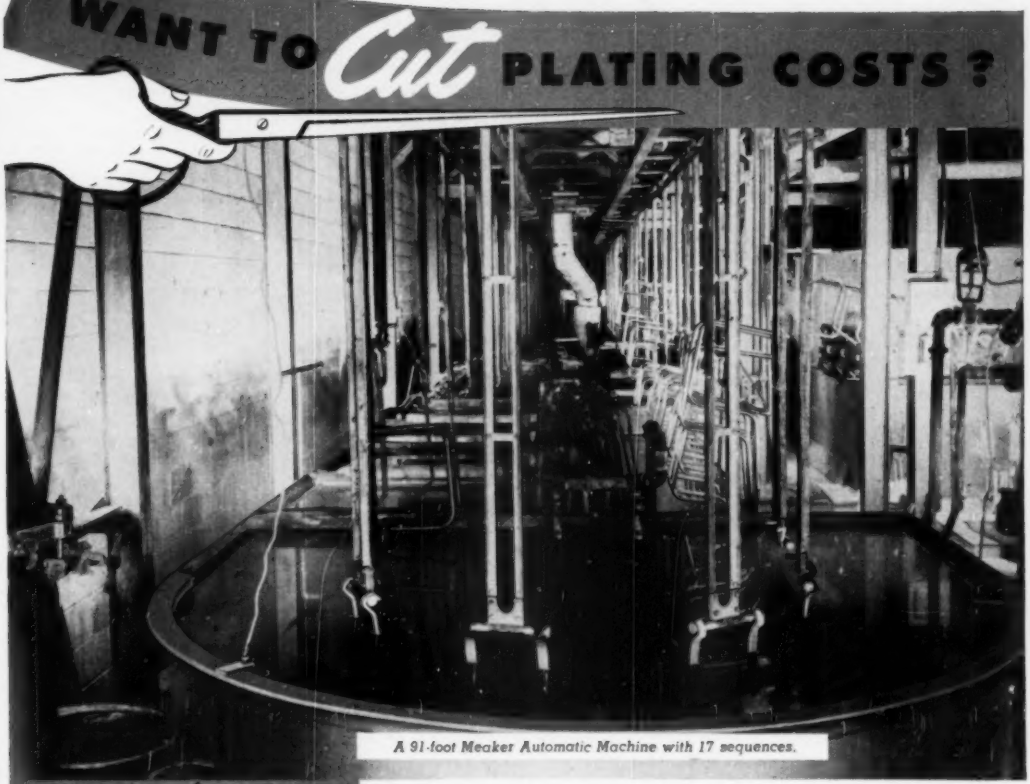
The Pacific Coast Plant of Parker Rust Proof Company is now in operation at 3710 Fruitland Avenue, Maywood, Calif. Many Parker products are being manufactured at the Maywood plant, and more will be made there in the future. Warehousing of the entire Parker line at the new plant allows prompt service and shipments to the metal working industries up and down the West Coast.

Manager of the Maywood plant is S. N. Headlee, who has been Parker's Pacific Coast regional manager for the past several years.

An Evening Lecture and Laboratory Course in Industrial Electrochemistry and Electroplating will be given at the Brooklyn Technical High School starting in September. There will be no charges for the course, which will cover basic chemistry, electrochemical principles, chemical analysis, and practical electroplating. Emphasis will be on laboratory work, wherein the students will carry out investigations in cleaning, electrocleaning, bright plating, and plating from all the commercial baths. Field trips to commercial plating plants and lectures by guest experts are also planned.

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A 615.

WANT TO *Cut* PLATING COSTS?



A 91-foot Meaker Automatic Machine with 17 sequences.

Get Results with a MEAKER PLATING MACHINE

You save three ways with a Meaker plating machine. In many cases the savings in labor costs, space, and chemicals alone have paid for the Meaker equipment in a very short time. Increased production is a natural result. A better and more uniform plating job is assured. Furthermore, cleaner and more agreeable working conditions reduce personnel turnover to a minimum.

A Meaker machine makes every operation in the plating sequence automatic, or as mechanized as possible. It is the profitable way to do electroplating on a competitive basis. Large percentage savings have been the rule both in the plating departments with medium output and in the mass production plants.

Look to the handling methods in your plating work. There may be an opportunity to save a lot of money. Whatever your requirements call for—full automatic, semi-automatic, or a special machine—Meaker has the answer. Get the Meaker booklet. It shows actual installation photographs of machines that have reduced operating costs for others—these machines can do the same for you.

Ask for Booklet No. 148

MEAKER PRODUCTS

Serving the Plating Industry for over 50 Years

THE MEAKER COMPANY

1639 South 55th Avenue, Chicago 50, Illinois, Telephone Bishop 2-1920

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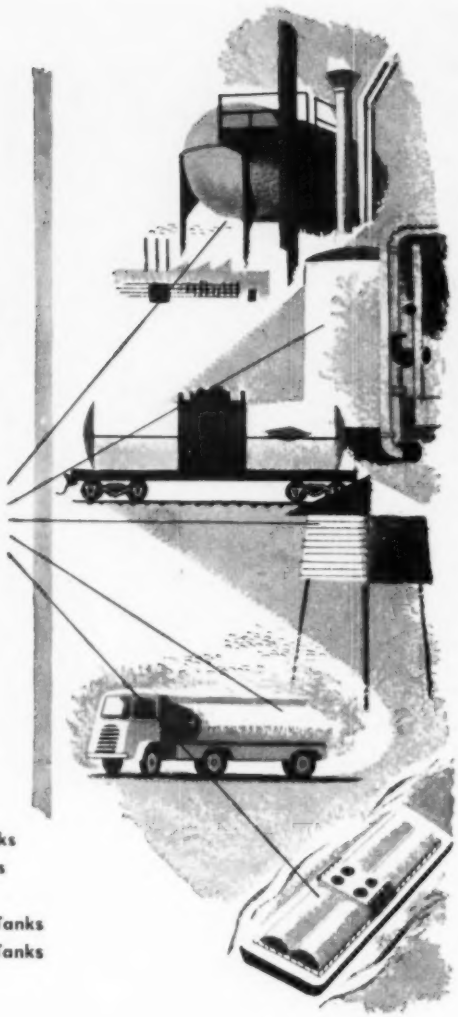
cut
corrosion
costs
with

SARAN RUBBER TANK LINING



in **Storage Tanks**
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Processing Tanks
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Increase the life expectancy of costly equipment with saran rubber tank lining. The high degree of both chemical and abrasive resistance makes saran rubber an outstanding lining where resistance to grease, solvents, acids and many other chemicals is required.

Saran rubber can be applied easily and economically by experienced tank lining applicators located strategically throughout the country. Investigate this superior tank lining today. Contact your nearest Saran Lined Pipe Company office and find out how you can add years to the life of your costly equipment. Write: Dept. TSP-91.

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DOW CHEMICAL

Industry News

Anyone interested in taking the course should contact, preferably in writing, Mr. James P. Striffler, Brooklyn Technical High School, De Kalb Avenue and Fort Greene Place, Brooklyn, N. Y. Early registration is suggested, as a number of persons who can be accommodated may be limited.

Wyandotte Chemicals, J. B. Ford Division, Technical Service Staff. Seated, left to right: Lee H. Minor; Ruth Crook, P. N. Burkard, Director; Kathleen Valentine, Donald Anderson, assistant to Mr. Burkard. Standing: J. D. McGillivray, H. J. Baecker, Howard E. Hastedt, Armin Roth, Robert Racine, Howard Anderson and Al Weimar. These men are specialists in metal cleaning and processing, maintenance cleaning, in fact their experience and reference files cover most cleaning, washing, and sanitary processing operations known to modern business and industry

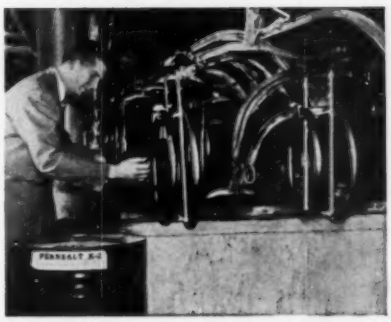
The Electric Products Company, Cleveland, Ohio has appointed **K. I. Clisby Associates** district representatives for the eastern section of Pennsylvania, the southern counties of New Jersey, most of Maryland, and the entire state of Delaware. With offices in Philadelphia, Pa., K. I. Clisby Associates will be responsible for promoting the Electric Products Company line of motors and generators, frequency changers, etc.

Experimental Automatic Buffing Department. The Acme Manufacturing Company, 1645 Howard Street, Detroit, Mich., has installed an experimental buffing department in its new plant. This department will have the largest and most complete display of all types of automatic buffing equipment under power and is to be used for determining the best sequences of operations for automatically finishing all types of materials, as well as for operating demonstrations to buyers. Straight-line, rotary semiautomatic, and special machines will be set up on the display and demonstration floor.

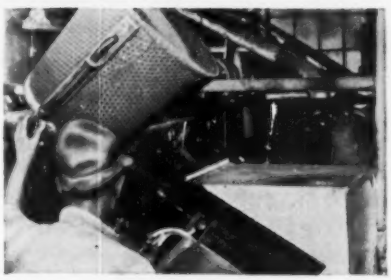
Fish Kill in Connecticut. According to a Hartford newspaper, four concerns in Winsted doing copper plating are being investigated in connection with the poisoning of thousands of fish in the west branch of the Farmington River. One of these plants dumped 600 gallons of waste

At Maytag
quality control counts
...and PENNSALT CLEANERS fill the bill

1 Pennsalt Cleaner being used in a Stevens Automatic Conveyor machine at the Maytag Plant. Pennsalt K-2 Cleaner is used in proportions of 8 oz. to a gal. of water at 212° F. for a 2-minute electroclean.



2 Along with the conveyor-type cleaning machine, Maytag uses this Stevens Automatic Barrel machine for cleaning small parts. Same solution of Pennsalt Cleaner is used as on conveyor cleaner.



3 The Washer that goes to the cleaners first! The Maytag Automatic Washer is a favorite among home-makers throughout the country for its smart appearance and long life. Pennsalt Cleaners are also used for cleaning the sheet steel prior to porcelain enameling for outside parts.

In the Maytag Company's Newton, Iowa, manufacturing plant, Pennsalt Cleaners take on the tough job of removing cutting lubricants, drawing and stamping compounds, carbon smut, and shop dirt from washing machine parts prior to zinc plating. In *just two minutes*, Pennsalt Cleaners remove this soil; get steel parts clean and ready for subsequent finishing steps. This is quick, efficient, *economical* cleaning—the kind you can count on with Pennsalt Cleaners in your plant!

There are efficient Pennsalt Cleaners for every metal-finishing operation—a special cleaner to meet every problem. ***And all Pennsalt Cleaners have these advantages in common:***

They are concentrated cleaners—most of them anhydrous. You can use a minimum of cleaning compound; you don't pay for excess water.

They have long life—frequent dumping of large process tanks is unnecessary. Furthermore, most Pennsalt Cleaners are made from *fused* materials—you get a uniform solution every time you make up a new charge.

They are free rinsing in either hot or cold water. You get cleaner metal, less drag-out, less contamination of subsequent steps.

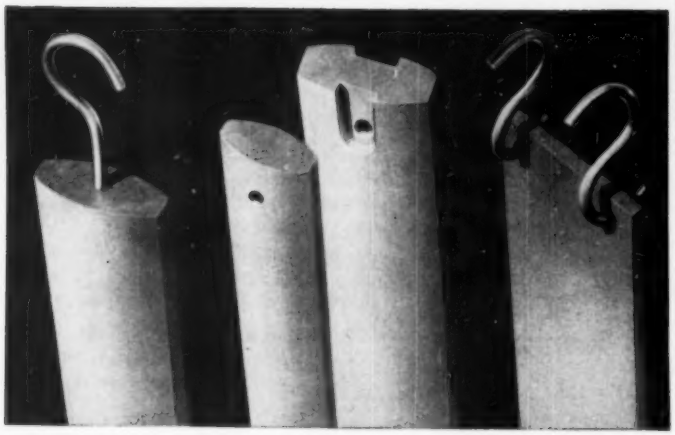
Get the complete story on Pennsalt Cleaners and how they can save time and money in your plant. The Pennsalt Representative in your locality will be glad to study your present cleaning method and make recommendations without obligation. Or, write: Special Chemicals Department, Pennsylvania Salt Manufacturing Company, Philadelphia 7, Pa.

There's a Pennsalt Cleaner
for every
metal cleaning operation

PENN SALT

PROGRESSIVE CHEMISTRY FOR A CENTURY

ANACONDA
means purity in copper anodes



WHEN you specify ANACONDA, you are assured of unexcelled purity . . . less than 0.01 percent of total metallic impurities . . . an advantage that pays off five ways:

1. *Copper goes into solution faster and more uniformly.*
2. *The highest quality deposit is produced in the shortest possible time.*
3. *Slime is reduced to an absolute minimum.*
4. *Spotting and discoloration of the deposit are minimized.*
5. *Scrap losses are exceptionally low.*

In addition to copper, ANACONDA Anodes are furnished in brass and bronze . . . rolled sheet or oval . . . cut to your own specifications or standard sizes . . . drilled or undrilled . . . with or without hooks—also copper "cathode-anodes". For present or future reference, write for Publication C-5, The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

for Plating with Copper, Brass or Bronze

Use ANACONDA Anodes

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 619.

Industry News

cyanide solution shortly before the kill, and examination has shown that the fish died from cyanide poisoning. Chief Engineer William S. Wise of the State Water Commission, who made this disclosure, stated that the Commission is going to insist that the concerns in question install waste-treatment systems, although the regular cyanide waste from them usually is in such small doses that they are not immediately toxic to fish.

If a single plant is found guilty of the poisoning, it could be brought before the Board of Fisheries and Game and given a heavy fine.

The George L. Nankervis Company, manufacturers of plating, buffing, and metal-finishing equipment, announces the purchase of the **Electro-Mechanical Devices Company** of Detroit as a wholly owned subsidiary. Electro-Mechanical Devices Company (EMDCO) designs and builds dynamometers, control panels, test strands, and special machinery and products to serve the needs of the automotive and aircraft industries for production- and quality-control equipment. It will be known as the Electro-Mechanical Devices Division of the George L. Nankervis Company.

The two companies are consolidating their facilities in a new plant located at 19255 West Davison. The new building provides modern facilities for factory, research, engineering, executive and general offices.

Mr. George L. Nankervis, President of the Company, announces the appointment of Henry W. Grikscheit as Vice-President and Director of the Electro-Mechanical Devices Division. Mr. Grikscheit brings with him the entire former personnel of the Electro-Mechanical Devices Company. Mr. H. M. Cherry, whose experience in the metal finishing field extends over thirty years, has been appointed Vice-President and Director of Sales of the Plating, Buffing, and Metal Finishing Division.

Steel Spends Millions to Keep Streams Clean. According to the April, 1950 issue of Steel Facts, the steel industry spends about ten million dollars annually to keep clean the streams it uses. In addition, the industry has more than ten million dollars invested in equipment to purify its major waste liquid, used "pickle liquor".

Most of the 600 million gallons of waste

What is RINS-AID?

RINS-AID is a new product that has unusual properties in giving a water-repellent film to freshly plated work when dipped in a static rinse tank containing only 10 ounces of RINS-AID per 100 gallons of water.

Why do Plated Parts Need RINS-AID?

Rinsing is an essential step in every plating operation but presents its own problems of drying and staining of practically all metals. RINS-AID solves these two problems simply because the water repellent surface it forms on freshly plated parts makes almost all of the water flow instantly from the surface before staining occurs.

What Else Does RINS-AID Accomplish?

RINS-AID imparts a buffed appearance to chrome, gives a uniform velvety appearance to cadmium, eliminates buffing of stained parts, in many cases eliminates sawdust drying, removes water from the inside of tubes and other inaccessible areas, and makes active electropolished or bright dipped surfaces dry better without staining. The final hot water rinse is kept cleaner and operates cooler, avoiding rapid rusting and scaling of steel tanks.

Is RINS-AID Expensive to Use?

All these advantages are yours at negligible cost because such a very small concentration of RINS-AID is used in a static rinse and is effective for hundreds of square feet of work.

ROHCO

ROHCO PRODUCTS
NO-CRO-MIST • HULL CELL TEST •
ROHCO 20XL CADMIUM BRIGHTENER
ROHCO 100 BARREL ZINC BRIGHTENER
• RINS-AID • CROMETER

R. O. HULL & CO., INC.
1302 Parsons Court
Rocky River 16, Ohio
Canada: Armalite Company, Ltd.
Toronto 6, Canada

"YOUR PLATING IS BEST WITH THE HULL CELL TEST"

SEE FOR YOURSELF • *JUST PIN THIS COUPON TO YOUR LETTERHEAD!!*

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Gentlemen: Please send at once, on our order—

☐ One Quart of RINS-AID ☐ Send FREE Literature
☐ One Gallon of RINS-AID

Name .....
Company .....
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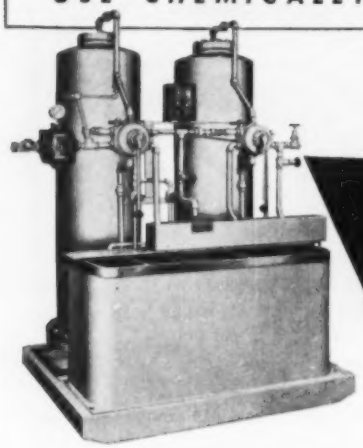
City ..... Zone ..... State .....

Eliminate Hot-Rinse Stains Unwanted Precipitates

USE CHEMICALLY PURE WATER



only a few cents a thousand gallons with . . . .

INDUSTRIAL Water Demineralizers

A Two-Bed INDUSTRIAL Water Demineralizer. Standard two- and four-bed units available with capacities of 200 to 1000 gph. Special units of any capacity engineered to requirements.

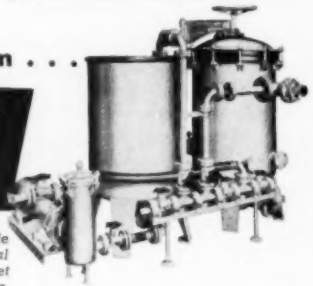
and it's as simple as it looks . . .

besides the extremely low cost, there is nothing complicated about getting the chemically pure water with Industrial Demineralizers. Raw water is passed through either two or four beds of ion-exchange resins and it comes out free of the dissolved mineral salts. No still, heat, steam, or cooling water is needed—keeping space requirements relatively small.

And it's simple to get the complete facts for your case. Send us a water analysis and let us know how much water you have to treat and the gallons per hour needed. We can then give you the whole demineralizer story including estimated costs, equipment required, performance data, etc. for your requirements.

for solution clarification . . .

use an **INDUSTRIAL Filter**



100 to 15,000 gallons per hour. Portable and stationary models. Standard or special filtration systems engineered to meet unusual requirements.

Write for full information and recommendations

FILTERS Pressure Type · PUMPS Centrifugal · CORROSION TESTING APPARATUS Salt Fog • Humidity

INDUSTRIAL FILTER & PUMP MFG. CO.

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RUBBER DIVISION Vulcanized Linings • Molded Products · WATER DEMINERALIZERS

Industry News

pickle liquor is rendered harmless by the steel industry before disposal each year. This compares with six billion gallons of community sewage released to the nation's waterways daily, 40 per cent of which is not chemically treated.

Cowles Metal Cleaning Clinic. Theme of the recent sales clinic conducted by Cowles Chemical Company, Cleveland, Ohio, was "Buffing Compound Removal was a Tough Job"! Pictured in

From left to right (seated): Fred H. Hitchcock, John W. Dobson, Robert L. Smith, M. P. Boland and Norman E. Garman; (standing): J. A. Barnes, Clyde E. Lowe, E. A. Lord, Technical Director C. W. MacMullen, Manager E. F. Clark, Charles W. Churchill, and C. G. Ozar

the photo are members of Cowles Metal Cleaner Technical Staff who participated in the discussions and demonstrations. Formal announcement of a series of new Cowles products specifically designed for efficient buffing compound removal was made at the clinic. Technical Director C. W. MacMullen, M. P. Boland, and C. G. Ozar conducted a series of technical discussions, and E. F. Clark, Manager of the Metal Cleaner Department, led the discussions on sales problems and policies.

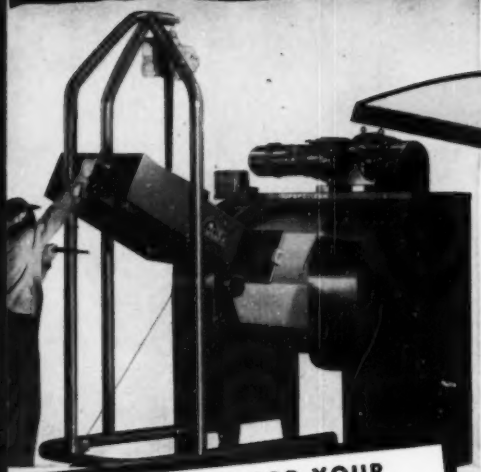
The Illium Corporation is the new name adopted by **Burgess-Parr Company,** Freeport, Ill. It was selected because of the close association of the company with its principal product, Illium, an extremely corrosion-resistant alloy formulated by Dr. Samuel W. Parr over 20 years ago. Parr named his alloy "Illium" in honor of the University of Illinois, where pioneer research was conducted.

Foster D. Snell, Inc., chemists and engineers, have affiliated with Mr. Albert C. Barrat, 54, Avenue de Neuilly, Neuilly, Seine, France. Mr. Barrat will represent the Snell organization in France and will supply firms in Europe with information on technical services that the Snell firm has to offer them. He will also act as a qualified foreign consultant to the clients of the Snell organization in the United States.

Xylenesulfonic Acid Prices Slashed. Prices on the refined grade of xylenesulfonic acid have been reduced by 30–50 per cent, depending upon quantity, ac-

DO ALL OF THESE PARTS WITH "ONE OPERATION" MASS PRODUCTION FINISHING AT A COST SAVING OF UP TO 95% WITH

ALMCO Supersheen
A Better Finish-FASTER



EQUIPMENT FOR YOUR SPECIFIC NEEDS

(1) Advanced Design PRECISION Tumbling barrels in sizes from 8" x 16" up to 60" x 30". (2) AUTOMATIC loading, unloading and separating equipment. (3) A vastly SUPERIOR grinding and finishing medium in 2 grades and 9 sizes.

DEBURR

Flat or formed stampings — **all** types and sizes . . . long, thin, slotted, etc. All common metals, including magnesium and copper. Machined parts with large burrs. Large, heavy or extremely light parts can be "one operation" processed without damage.

CUTTING DOWN, POLISHING, BURNISHING, PUTTING ON RADIUS

Castings — **all** types — **all** common metal alloys. Forgings before and after machining. Machined parts. Stampings requiring smooth surfaces and high colors.

DESCALE, DEBURR, POLISH

Forgings before and after machining. Heat treated parts. Welded or discolored parts.

COMPLETELY FINISH FROM CASTING OR FORGING TO PLATING OPERATION

Forged or cast brass, iron. Die castings of all sizes, shapes and types.

ALSO

Selective grinding. Low micro-inch surfaces equal to lapped finishes can also be obtained with absolute uniformity.

● GET THESE BENEFITS

A Better Finish **Faster** on widest range of parts. Reduced time, labor and material costs . . . **up to 95% saving!** Reduced rejections — stepped-up production. Unsurpassed uniformity — improved finish.

● OUR SERVICE TO YOU

We survey your requirements — determine by Trial Runs if ALMCO SUPERSHEEN is applicable. Furnish Engineering Data Card — specific fool-proof instructions on how to run each part. Train operators for highest efficiency. Furnish continuing information on latest finishing procedures.

FREE *Engineering Clinics*

Nationwide Network provides you with QUICKER and BETTER sample processing. Write today for details — or send unfinished samples for FREE Engineered Pilot Run and complete production cost data.

FREE SAMPLE PROCESSING
■
GET FACTS TODAY

ALMCO DIVISION, Queen Stove Works, Inc.
Albert Lea, Minn., Dept. PL-8

Please send me latest descriptive literature and address of nearest SUPERSHEEN Engineering Clinic.

NAME_____

ADDRESS_____

_____

America's Most Versatile "ONE OPERATION" Finishing Process

ACP

PHOSPHATE FINISHES TO MAKE YOUR PRODUCT DURABLE

PAINT BONDING

"Granodine" forms a zinc-iron phosphate-coating bond on sheet metal products — automobile bodies and fenders, refrigerator cabinets, etc. — for a durable, lustrous finish.

"Lithoform" makes paint stick to galvanized iron and other zinc and cadmium surfaces.

"Alodine", the new ACP protective coating chemical for aluminum, anchors the paint finish and protects the metal.

RUST PROOFING

"Permadine", a zinc phosphate coating chemical, forms on steel an oil-adsorptive coating which bonds rust-inhibiting oils such as "Granoleum."

"Thermoil-Granodine", a manganese-iron phosphate coating chemical, forms on steel a dense crystalline coating which, when oiled or painted, inhibits corrosion.

PROTECTION FOR FRICTION SURFACES

The oiled ***"Thermoil-Granodine"*** coating on pistons, piston rings, cranks, camshafts and other rubbing parts, allows safe break-in operation, eliminates metal-to-metal contact, maintains lubrication and reduces the danger of scuffing, scoring, galling, welding and tearing.

IMPROVED DRAWING AND EXTRUSION

"Granodraw" forms on pickled surfaces a tightly-bound adherent, zinc-iron phosphate coating which facilitates the cold mechanical deformation of steel, improves drawing, and lengthens die life.

Write or call for more information on these products. Send for new descriptive folder on ACP Metal-Protective and Paint-Bonding Chemicals.

American Chemical Paint Co.
AMBLER PENNA.

Industry News

cording to an announcement by Wyandotte Chemicals Corporation, Wyandotte, Mich. Among applications are: (1) the surface treatment of metal; (2) selective extraction of certain hydrocarbons; (3) as an acid in electroplating baths to the rapid deposition of fine-grained, ductile plate of good adhesion and high luster; and (4) as an active ingredient of scale-removal compounds, acid cleaners of all types, and paint- and varnish-remover formulations.

Air Pollution and Industrial Hygiene Mobile Laboratory. The only one of its type in the country, such a laboratory has recently been placed in service by the Bureau of Industrial Hygiene of the State of Pennsylvania.

Designed and supplied by Mine Safety Appliances Company, Pittsburgh, the laboratory is equipped with more than 25 scientific devices for field sampling and qualitative analyses of atmosphere in industrial communities and factories. It is in a closed route van-type body with specially designed built-in work benches, cabinets, racks and storage compartments. It is equipped with a gasoline-motor-driven generator for electrical service, a 30-gallon fresh-water tank, a 10-gallon distilled-water tank, and two liquified-petroleum-gas tanks to supply fuel for Bunsen burners. Special instruments developed by Mine Safety for separately detecting hazardous gases or fumes, such as carbon monoxide, chromic acid mists, nitrogen dioxide, benzol, and hydrogen sulfide, are among the equipment.

HELP WANTED

Excellent opportunity for chemist with experience in all types of buffing and polishing compositions —formulations—manufacture and application. In reply, give complete transcript of education and experience. Salary open.
Reply to:
P-850A, PLATING
P. O. Box 168, Jenkintown, Pa.

SITUATION WANTED

Metal Finishing Engineer—B.S. in Chemical Engineering. Extensive experience in all phases of Metal Finishing. Has a good appreciation of problems involved in design, plant layout, operation, maintenance, production costs, and quality control. Seeks position in engineering or technical service.
Reply to:
P-850 B PLATING
P. O. Box 168, Jenkintown, Pa.

FASTER, BETTER FINISHING with HARRISON'S NEW

4A

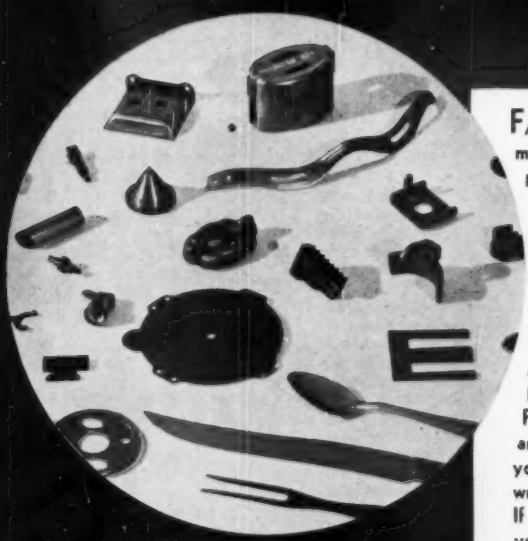
BUFFING AND POLISHING COMPOUNDS

You send us sample of metal used. We will return finished sample together with compound for your specific requirements.

Speed up production with correct compositions.

HARRISON & COMPANY
Incorporated
HAVERHILL, MASSACHUSETTS

Are You Finishing Your Metal Parts *the Economical Way?*



FAST, economical barrel finishing is proving more profitable in many plants than slow, hand polishing, for preparing a variety of intricate metal parts for subsequent plating operations. You can remove objectionable heat scale, burrs, tool marks and dirt from your metal parts with this clean, modern process and with ALUNDUM Tumbling Abrasive—the ideal barrel finishing medium. You can finish large quantities of parts to exact dimensions and degrees of surface finish and prepare them for plating—ALL IN ONE OPERATION! For full details on the barrel finishing process and ALUNDUM Tumbling Abrasive—contact your Norton abrasive engineer or distributor, or write direct to the Sales Engineering Department. If you don't have barrel finishing equipment in your plant, and if you would like to find out without obligation what this finishing process and this Norton product can do for you—Norton will be glad to make test runs for you.

NORTON COMPANY . Worcester 6, Mass.
Distributors in All Principal Cities

NORTON
ABRASIVES

Personals

James J. Malone, Assistant General Manager, has been promoted to Vice-President of United Platers, Inc., Detroit, Mich, with which he has been associated for fifteen years.

Malone

Mr. Malone is active in the American Electroplaters' Society and also in the Plating Institute, of which he is Vice-President and a member of the Board of Directors. He also is keenly interested in the affairs of the Businessmen's Boys' Club in the Detroit area.

Dr. Charles L. Faust, head of electrochemical engineering research at Battelle Institute, Columbus, Ohio, was elected President, **Dr. R. J. McKay,** chemical engineer for the International Nickel Company, a Vice-President at the recent meeting of the Electrochemical Society.

A. W. Hothersall, noted English electroplating researcher, received the Society's Gold Medal at the recent Silver Jubilee Conference of the Electrodepositors' Technical Society, England.

Arthur Wesley Hothersall was born at Mytholmroyd, Yorkshire on November 10, 1895. The son of a Wesleyan Methodist minister, he was educated at Kingswood School Bath; he graduated from Manchester College of Technology with first-class honors in Applied Chemistry (Metallurgy), later obtaining the degree of M.Sc. (Tech) for electrodeposition research. He served as Assistant Chemist to High Speed Steel Alloys, Ltd., Widnes and Taloy, Burma, for six years and then, in 1921, joined the Metallurgical Branch of the Research Department, Woolwich (now the Armament Research Establishment), where he has since been employed. He assisted Mr. D. J. Macnaughtan on electrodeposition research until 1933, when he took charge of the electrodeposition and corrosion work. He has published numerous papers on electrodeposition and is now a Senior Principal Scientific Officer in the Scientific Civil Service, a Fellow of the Institution of Metallurgists, and a member of the Iron and Steel Institute and the Institute of Metals. He has been a member of the E. T. S. since its formation and served as President from 1937 to 1939. He has twice visited America, once in 1939 when he attended the Second International Conference on Electrodeposition at Asbury Park and again in 1945. He is married and has two daughters.

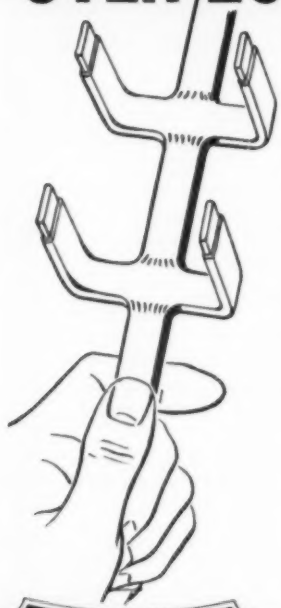
Hothersall

C. W. Craig and **C. E. Ericson** have been appointed Manager and Comptroller, respectively, of the North Chicago (Ill.) branch of the Atlas Powder Company's Industrial Finishes Department. **Casper Apeland,** formerly Branch Manager, has been named special representative for market research for both the North Chicago and Stamford, Conn., plants.

Craig

A graduate of Hiram College, Hiram, Ohio Mr. Craig has been with Atlas for ten years, the past three as Assistant Manager at North Chicago. Mr. Ericson graduated from Lake Forest College and has been with Atlas since 1933. He has

COATING SURVIVES OVER 2500 CYCLES!



UNICHROME COATING 218X *again proves that it minimizes rack upkeep*

At a Michigan plating plant, Unichrome Coating 218X is considered to be "the best rack coating ever used." For good reason. Racks protected with this green plastisol coating have been working 16 cycles daily for 8 months — and the coatings are *still* in good condition!

Such service is not unusual for Coating 218X. It's one of the toughest materials — physically and chemically — that can be put on racks. It stands up in all plating baths, all cleaners — even vapor degreasers. Coating 218X is approved for leading bright nickels. Applicable in flexible coatings up to 3/16" thick, it won't tear or chip. And with but a *single* prime coat of Unichrome Primer 219PX used, you assure not only better adhesion, but savings in application time as well.

A United Chromium engineer is always ready to show you how to apply Coating 218X for top results. Or if you have no baking facilities, we'll gladly send you names of nearby qualified applicators who can apply it for you. Either way, you stand to gain substantial savings in rack maintenance. Send for data.

UNICHROME Trade Mark COATINGS for METALS

Metallic ..... Organic ..... Decorative ..... Protective

Products of UNITED CHROMIUM, INCORPORATED

100 East 42nd St., New York 17, N. Y. • Detroit 20, Mich. • Waterbury 90, Conn. • Chicago 4, Ill.
Los Angeles 13, Calif. • In Canada: United Chromium Limited, Toronto, Ont.

No Other Process Yields Such Brilliant Zinc Deposits Without Dipping!

If you want a really brilliant zinc plate, adopt this Du Pont process using:

DU PONT "ZIN-O-LYTE" ZINC PLATING CHEMICALS

CHECK THESE OUTSTANDING FEATURES

1. **YIELDS BRILLIANT** blue-white, rust-resistant deposits direct from the bath without *bright dipping!*
2. **GOOD OPERATING EFFICIENCY.**
3. **BATHS EASILY** made up from prepared salts.
4. **SUITABLE** for all types of zinc plating, *particularly barrel plating.*
5. **SATISFACTORY** for use with almost all types of ferrous metals.

E. I. du Pont de Nemours & Co. (Inc.)
Electrochemicals Department, Wilmington 98, Delaware

GET YOUR FREE COPY of our manual on plating with "Zin-O-Lyte" zinc plating chemicals. Packed with helpful facts. Just clip this coupon!

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Chemicals · Processes · Service
for ELECTROPLATING

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BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.)
Electrochemicals Department
Wilmington 98, Delaware

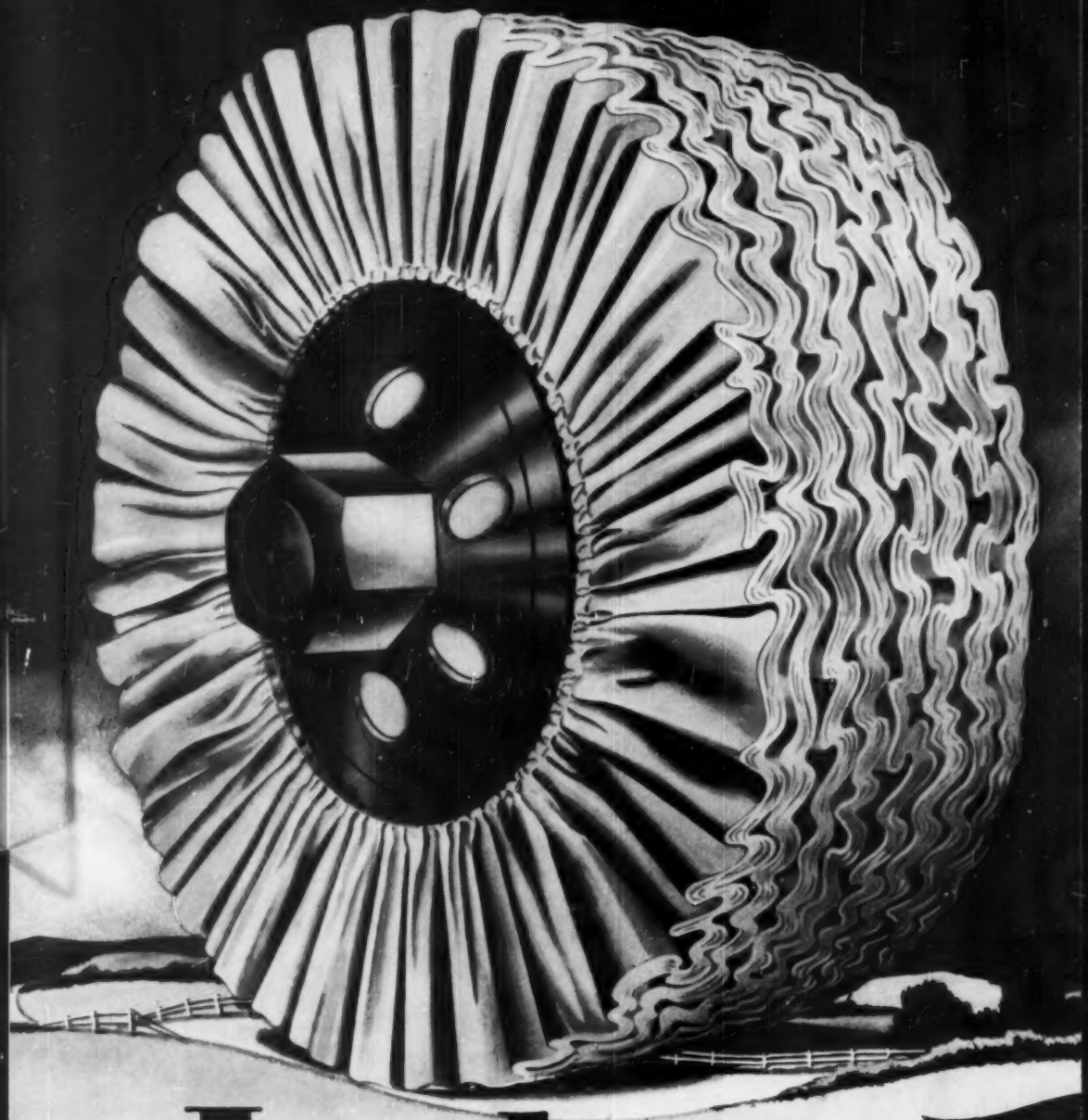
Please send me a copy of "Operating Instructions for Bright Zinc Plating".

Name_____

Firm_____ Title_____

Address_____

What's your



Jackson

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21-03 FORTY-FIRST AVENUE

buff mileage?

...spark plugs.

...your buffs with the same discrimination. Don't ...your buffs be the flat tire in your polishing ...

JACKSON AIRWAY VENTILATED BUFFS ... type will . . .

1. Out-produce any other ...
2. Out-perform any other ...
3. Reduce your net buf...

We will supply the samples. ... you in any and all of you... one of the types of **JACKSON** ... BUFFS will do your job with the ...

...for a representati...

...AY ...ted **Buffs**

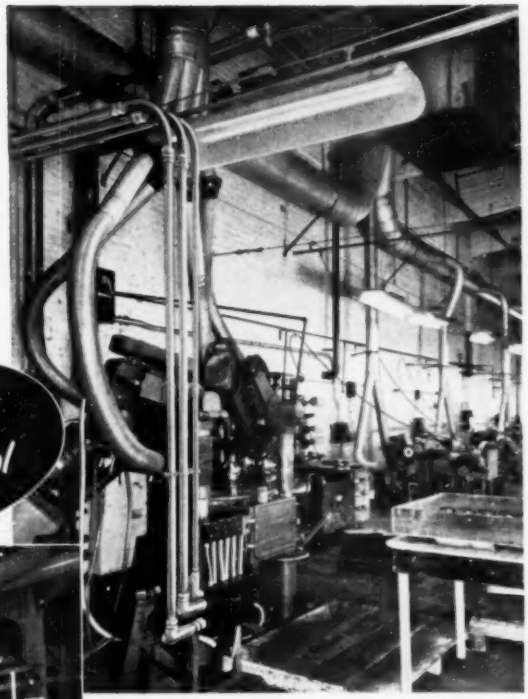
WARNING NOTICE—Jackson Buff Corp. of Long Island City, N. Y., has rights to U. S. Patents Nos. Re 19,894 and 2,140,208 which have broad claims covering an air cooled buff having means for the admission of air through the sides of the buff. Owner intends to protect all rights and stop infringement.

LONG ISLAND CITY 1, N. Y.

3 Problems— 1 Solution

... KIRK & BLUM!

Below: High velocity, double-slot hoods effectively pick up fumes as formed, remove them through corrosion resistant piping and exhausters.



Above: Dust Collecting System; note flexible connections permitting movement of automatic buffing and polishing machine. Below: Two-pass monorail conveyor through direct fired gas oven.

Illustrating Kirk and Blum's wide experience and money-saving ingenuity are these installations in the plant of a large auto accessories manufacturer. Three separate systems eliminate fumes from pickling and plating tanks, control dust in polishing and buffing operations and provide accurately controlled heat for enamel baking in a conveyorized overhead oven. These are examples of the hundreds of systems designed, fabricated and installed by KIRK & BLUM. Turn your dust control, fume removal or low temperature oven problems over to experts with 40 years' experience.

DUST AND FUME CONTROL SYSTEMS

INDUSTRIAL OVENS

KIRK AND BLUM

THE KIRK AND BLUM MANUFACTURING COMPANY, 2887 SPRING GROVE AVE., CINCINNATI 25, OHIO

Personals

held the post of Office and Credit Manager. Mr. Apeland was one of the founders in 1919 of the Brevolite Lacquer Company at North Chicago, later acquired by the Atlas Powder Company.

Donald E. Mason has been appointed General Sales Manager of Colonial Rubber Company, Ravenna, Ohio affiliated

Mason

with The U. S. Stoneware Company. He was associated with the B. F. Goodrich Company for over eight years, gaining wide experience in solving special or custom rubber-molding problems. He joined Goodrich in 1938 upon receiving his B.S. degree in marketing from Ohio State University. During the war he was associated with the Atlas Powder Company and rejoined Goodrich at the end of the war in the Sundries Sales Division of the Industrial Products Department.

Arthur H. Losey is now Sales Engineer for the entire line of the Acme Manufac-

Losey

turing Company, Detroit, Mich. He is well known in the finishing field, having spent twenty-five years working in the metal finishing industry. Just prior to his association with Acme, he was District Sales Manager in the Cleveland area for Frederic B. Stevens, Inc. Mr. Losey will be in charge of the new processing department, which the company recently installed in its new plant.

Obituary

✤**George W. Pressell,** 62, Vice-President of E. F. Houghton & Company, Philadelphia, Pa., died suddenly on June 5 at his summer home in Ocean City, N. J.

Mr. Pressell was the oldest Houghton employee in point of service, having started as a messenger boy forty-seven years ago at $2.00 a week. He had held offices of Chief Chemist, Secretary, Second Vice-President, General Sales Manager, and Director of Sales. Since 1919 he had been a member of the Board of Directors. He was also President of E. F. Houghton & Company of Canada, Limited. He is survived by his widow and two married daughters.

✤**James M. Stewart,** fifty-three, President and General Manager of the Battle Creek Plating Corporation, Battle Creek, Mich., died on April 6 after an illness which had been serious for a year. He had been in ill health for three years.

Mr. Stewart helped establish the Battle Creek Plating Corporation in 1945. Before that, in 1943, he was instrumental in setting up the Hillsdale Plating Corporation, and after having sold out his interest a few years later, he bought back into it three years ago and was Vice-President at the time of his death.

Born in Battle Creek on March 27 1897, he began as a metal finisher with the Sherman Manufacturing Company and the A-B-Stoves Company. For several years he traveled for the Hammond Machinery Company of Kiamazoo, installing large automatic polishing equipment. For ten years prior to 1943 he was superintendent of the L. A. Darling Company of Bronson, Mich. In 1943 he helped establish the plating concern at Hillsdale.

He was a member and past officer of the Jackson-Lansing Branch of the American Electroplaters' Society and was a member of the National Small Businessmen's Association.

He is survived by his wife; two daughters, Mrs. Betty Kehoe and Mrs. William (Jacqueline) Gillett, both of Hillsdale; and six grandchildren. All who knew him remember a man who devoted his life to help his fellow men, particularly the little fellow. He did not even hesitate to go out of his way to show a competitor how a job should be done.

The industry has lost an outstanding figure.

in BURNISHING MATERIALS
it's the shape that counts!
When your product design requires a burnishing material which reaches into hard-to-clean corners . . . use Abbott Burnishing Diagonals. They're shaped to do the job right!
Abbott Burnishing Materials are available in five shapes . . . Ball, Ovalball, Cone, Diagonal, Pin . . . scientifically designed to make effective contact on any size and shape of metal stamping or casting. Each is a burnishing tool made from high quality, Abbott bearing ball steel, deep hardened and polished to a mirrorlike glass-hard finish. For the better results you must have to meet today's cost requirements . . . use Abbott!
Some parts require a special mixture of Abbott Burnishing Materials. Send for catalog showing sizes, shapes, uses. No obligation.
THE ABBOTT BALL COMPANY
1054 New Britain Ave.,
Hartford 10, Conn.
ABBOTT
the all round ball
FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A 630.

MUTUAL RESEARCH

LEADS WAY TO LOWER COST CHROMIC ACID TREATMENTS

Possible cost savings in chromic acid anodizing, as well as in other metal treatments such as copper stripping, brass pickling, magnesium dips and chromium plating, are indicated through the use of oxidation-resistant cationic exchange resins. In a preliminary investigation by Mutual Chemical Company of America, certain commercial resins have been found to be stable in the presence of chromic acid. As a result, these resins may be used for removing dissolved metals from chromic acid solutions with the recovered chromic acid made available for re-use. An added advantage is in minimizing the problem of waste disposal.

Write today for a copy of "Regeneration of Chromic Acid Solutions by Cation Exchange" Mutual's Serial No. 65

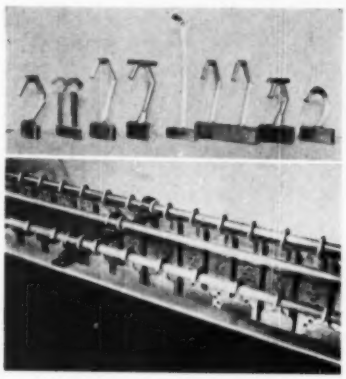
SINCE 1845

MUTUAL CHEMICAL COMPANY OF AMERICA

270 MADISON AVENUE • NEW YORK 16, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 631.

Get STORTS Anodes and Hooks working for you



STORTS Perforated Lead and Steel Anodes are designed for better current distribution. They wear well, handle easily and clean easily. Storts Anode Hooks are available in a number of styles and can be adapted for either round or rectangular shaped anode bars.

42 STONE STREET — STORTS WELDING COMPANY INCORPORATED — MERIDEN, CONN.

Manufacturers of Welded Fabrications to Specification

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 632.

Trade Literature

L—452. Chromic Acid in Chromium Plating, Aluminum Anodizing, Electropolishing and other Metal Finishing—Fiber Chemical Corporation, Cliffwood, N. J., offers a series of Technical Bulletins G 217 B 11-14 dealing, in order, with the aforesaid subjects. They are essentially annotated bibliographies, but deal mainly with the practical aspects of the processes. For your copies, write to the company on your own company letterhead and mention PLATING.

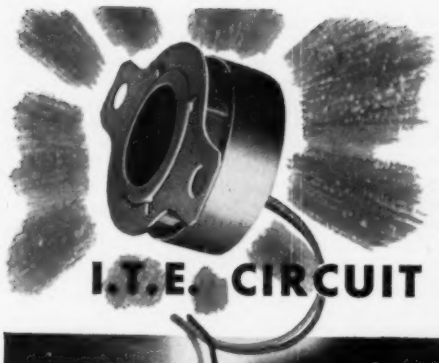
L—453. Lead Anodes—Republic Lead Equipment Company, 7930 Jones Road, Cleveland 5, Ohio has issued a 4-page bulletin, "Republic Homogeneous Lead Anodes for Chrome Plating", which describes and illustrates six types of anodes and ten kinds of anode hooks. The copper hooks are homogeneously burned to the anodes for positive contact. For your copy, use Reader Service Card.

L—454. Paint Stripping—An account of materials and procedures designed to simplify the removal of oil-base and synthetic paints, enamels, and similar finishes from metal surfaces is provided in an illustrated 14-page booklet, "How to Strip Paint", published by Oakite Products, Inc., 140 Thames Street, New York 6, N. Y.

The booklet discusses specific paint stripping materials and describes four simplified methods of removing paint from surfaces: (1) the hot flow-on method by which surfaces are flooded with hot solutions of stripping compound to remove paint from large areas or from parts too big for immersion stripping; (2) the cold-spray method, by which pressurized cold solutions are employed to strip paint from large parts when equipment or facilities are limited; (3) the steam-gun method, by which paint is blasted off surfaces by the combined action of steam and stripping compound; and (4) the tank-immersion method for parts in mass-production operations.

Also discussed briefly are materials for surface preparation of parts before repainting to promote paint adhesion and materials for anti-rust protection of stripped rejects awaiting repainting. For your copy, use Reader Service Card.

L—455. Tin Plating—A new technical bulletin on electro-tinning is available from Metal & Thermit Corporation, 100 E. 42nd Street, New York 17, N. Y., producers of tin and antimony chemicals. The 24-page pamphlet gives suggested bath formulae and performance data on both potassium and sodium stannate plating solutions, contains suggestions



Udylite JUNIOR AUTOMATIC

gives increased production... more uniform plating for

I.T.E. CIRCUIT BREAKER COMPANY

This Udylite Junior Automatic Plating Machine cleans and plates television receiver parts for I.T.E. Circuit Breaker Company. Uniform finish is essential to precision parts like this.

THE plating department of I.T.E. Circuit Breaker Company, Philadelphia, reports splendid performance by their Udylite Junior Automatic plating machine. Used primarily for finishing television receiver components—this Udylite unit incorporates BOTH cleaning and plating in ONE operation. The results are: greater quantity and improved quality of production with lower direct labor costs.

This is typical of the results gained by Udylite customers. In virtually every case they report that Udylite plating equipment and processes give them both cost reduction and increased quality of plating. You can reap these same rewards with Udylite. Call in your Udylite Technical Man and let him analyze your operation and make recommendations for bigger plating profits for you. Or write direct to the Udylite Corporation, Detroit 11, Michigan. There's no obligation.

THE

Udylite

CORPORATION

DETROIT 11, MICHIGAN

Pioneer of a better way in Plating

Trade Literature

and instructions for analysing and controlling the bath, and has a section devoted to the new high-speed tin anodes recently developed by the company. For your copy, use Reader Service Card.

L—456. Oiled Phosphate Coating—American Chemical Paint Company, Ambler, Pa., offers a revised Technical Data Service Sheet No. 11-5-3, which describes three grades of "Perolene", an oil-like chemical for use on phosphated iron or steel which is later to be painted. Functions, conditions for use, application, equipment, control methods, and methods for paint preparation are also discussed. For your copy, use Reader Service Card.

L—457. Electronic Timer—A compact electronic timer, which provides automatic control of operation, limit, and sequence timing for literally thousands of industrial processes, is described in a 4-page illustrated Bulletin GEA-5255 issued by General Electric Company, Schenectady 5, N. Y. Designed to fulfill industrial requirements for flexibility of application, accuracy and reliability in operation, low maintenance, and simplicity in servicing, it is available in three time ranges: 0.06–1.2 seconds, 0.6–12 seconds, and 6-120 seconds.

Some applications of the new device are: (1) operation timing to control duration of such processes as paint spraying, electroplating, and heat treating; (2) limit timing to stop conveyor belts if material piles up; and (3) sequence timing with two or more timers in combination to control duration of operations on machines, centrifuges, etc. For your copy, use Reader Service Card.

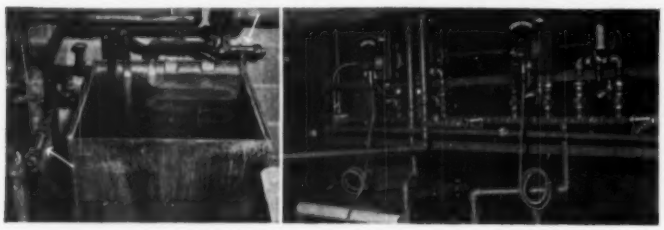
L—458. Heat Exchangers—A new Catalog Section M-8801.1 has been issued by National Carbon Division, Union Carbide and Carbon Corporation, 30 E. 42nd Street, New York 17, N. Y., which describes and illustrates the new Series 240A "Karbate" Brand Impervious Graphite shell-and-tube heat exchangers.

The new, larger standard 240A heat exchangers, similar in construction to the Series 70A and providing 71 sq.ft. of heat-exchange surface, possess all of the advantages of "Karbate" brand equipment, such as chemical resistance to practically all corrosive fluids, resistance to severe thermal shock, and high heat-transfer rates. Single-, double-, or four-pass routing of the tube-side fluid is effected by a simple change of fixed and floating and cover assemblies. In addition, oversize shell-side connections contribute to the flexibility of the new unit, which may be operated in either a vertical or a horizontal position. The maximum recommended hydrostatic operating pressure is 75 psi, maximum steam pressure 50 psi, and working temperature 338° F. Replacement of tubes is done easily in the field. The catalog section contains complete specifications, sectional dimension drawings, and ordering information. For your copy, use Reader Service Card.

L—459. Floor Repair—Stonhard Resurfacer, manufactured by Stonhard Company, 500 Stonhard Building, Dept. P, 1306 Spring Garden Street, Philadelphia 23, Pa., is used to patch or overlay floors of all types—concrete, brick, asphalt, wood, or even composition floors. It is said to make a smooth, tough, resilient, nonskid, spark-resistant surface, that withstands the heaviest trucking and assures a safe and comfortable footing.

Stonhard Resurfacer can be applied easily by your own maintenance men without any involved preparation of the materials, and repairs may be accomplished over any week-ends. For your copy of the new folder "No Floor Chopping", use Reader Service Card.

L—460. Caustic Soda—"The Story of Caustic Soda" is the name of the feature article in the April, 1950 issue of Alka-



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You may not be able to make your present equipment completely automatic but you can make it automatic as far as temperatures are concerned at very small cost. That means that no matter how the temperatures and pressures of your steam and water supply vary, or how you are loading the tanks, the temperatures will be within a degree of the point at which you set the dials of the Sarco LSI Plating Control.

It also means that you can change the settings in a second for each tank and each load. This includes all kinds of plating, and alternate heating and cooling. It means that you can read the temperatures on the big dial, custom-cut, for easy reading in your temperature range.

For wash tanks a low cost Sarco Thermoton hooked into the line like an elbow will hold the tank within a few degrees. And for degreasers you can select the Sarco Vapor-line Controls, or the Sarco TR-40 Cooling Control. To save steam, Sarco Traps and Strainers are recommended for each tank or steam coil.

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270

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Trade Literature

Lines, house organ of Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio. It describes and illustrates the manufacture of this important basic chemical by the lime-soda and electrolytic processes and indicates its many uses. For your copy, use Reader Service Card.

L—461. Cartridge-type Demineralizer—The Hydrion Canister Demineralizer, described in a 10-page illustrated folder issued by A. E. Tomkin & Company, 1828 Columbia Road, N. W., Washington 9, D. C., provides a means for a ready and economical supply of chemically pure water directly off any water tap without the need for expensive cartridges. The capacity of the C5IL Unit is ideal for use in small-scale electroplating operations and for spot location work. For your copy, use Reader Service Card.

L—462. Dust Control—A bulletin, "The Use of Dustube Collectors in the Metal Industry", is the latest industry report on the subject issued by American Wheelabrator & Equipment Corporation, 11 S. Byrkit Street, Mishawaka, Ind. It describes methods to improve health and working conditions and to increase production and lower costs in grinding, blast cleaning, etc. For your copy, use Reader Service Card.

L—463. Aluminum Paint—A comprehensive 32-page brochure, "Painting with Aluminum", is now available from Aluminum Company of America, 801 Gulf Building, Pittsburgh 19, Pa. This treatise is made available to production men and others in industry who request it on company letterheads.

L—464. Temperature Controlling Instruments—New measuring, exhibiting, and controlling temperature and pressure instruments offered by the Fischer & Porter Company, Hatboro, Pa., are described in its 12-page illustrated catalogue 86. Temperature instruments (Ratotherm) have thermal systems filled with liquid, vapor-liquid, or gas covering ranges between −125° F and +1000° F depending on the application. For your copy, use Reader Service Card.

L—465. Air Filter of Glass—A replaceable-type air filter, the "Amer-glas", made in all standard sizes for forced air heating, ventilating and air-conditioning systems, has been introduced by the American Air Filter Company, Inc.,

Louisville, Ky. According to 6-page illustrated Bulletin 211, the filtering media consists of continuous strands of glass filaments held together at each point of contact by a high-temperature plastic bond to form a resilient pad. The pad is sprayed with an odorless and nonflammable adhesive and placed in a fiberboard casing between metal grills. For your copy, use Reader Service Card.

L—466. Polyvinyl Chloride Coating System—A 5-page New Product Data Sheet C-11 is offered by Carboline Company, 7603 Forsyth Boulevard, St. Louis 5, Mo. It describes the properties of Polyclad coatings, including results of spark tests and corrosion tests, and pays particular attention to correct methods of application to metal, concrete, and wood. For your copy, use Reader Service Card.

L—467. Chain-Type Hoist—Yale & Towne Manufacturing Company, Philadelphia 15, Pa., now manufactures an electric chain-type hoist, which offers lifting speeds up to 41 feet per minute, 30° "pick-up" angle, and a lower- as well as an upper-limit stop. This hoist is available in load capacities of 500, 1000 and 1500 pounds. Standard models lift loads through any height up to 40 feet. Wound-up chain does not warp around a drum but collects in a metal container as the hook raises. Thus, for high lifts requiring long chains, all that is needed is a larger chain container. The single-strand load chain securely engages six pockets of the sheave to move and hold heavy loads with a minimum of chain friction. The control box is located at a level convenient to operator, and the flexible control cable carries only energizing current, not load current. For your copy of Bulletin P-1172, use Reader Service Card.

NEWEST DEVELOPMENTS
IN METAL CLEANERS

DU-LITE NO. 31 & 37
FOR SUPERIOR METAL CLEANING

31

A highly efficient cleaner, especially for the electrolytic cleaning of steel and all ferrous alloys prior to electroplating. Also may be used as a soak cleaner or a combination of soak and electrolytic. Compounded exclusively by Du-Lite for removing grease, oils, and drawing and buffing compounds. Economical in use and in price.

37

Du-Lite has perfected this new all purpose cleaner to be used as a soak, electrolytically, or both in combination for all metals, except aluminum. Du-Lite No. 37 is especially recommended for the cleaning of stainless steel, steel, zinc, nickel plate and brass. Will not tarnish die castings or brass. Competitively priced.

Du-Lite Cleaners No. 31 & 37, products of the Du-Lite Research Laboratory, have been thoroughly tested on regular run shop work, and are backed by Du-Lite's long experience in metal cleaning and finishing.

Write for trial order or call for the Du-Lite field engineer to discuss procedures for your particular problem.

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VOLUME 35: Physical Properties of Nickel Deposits; Measurement of Stress in Deposits and Its Effect on Thickness Determination; Judging the Quality of Plated Parts; Measurement of Porosity of Deposits; Oxidation of Trivalent Chromium in Chromium Plating Baths; Bright Barrel Plating of Nickel and Zinc; High-Speed "Bronze" Plating; Plating on Plastics; Strip Plating Evaluation; Electroplaters' Metals of the Future; Copper Plating without Roughness; Simple Test for Surface Cleanliness; Electropolishing; Engineering Planning in the Plating Department; Cost Finding and Estimating; Phosphatization of Steel; Conveyorized Spray Finishing.

VOLUME 34: Physical Properties of Electrodeposits; Physical Properties of Electrodeposited Chromium; Stress in Electrodeposits—Its Significance; Stress in Electrodeposited Nickel; Electroforming Pitot Static Tubes; Manufacturing Process for Reflectors; Protective Power and Porosity of Electrodeposits; Evaluation of Methods for Determining the Thickness of Electrodeposited Coatings; Experimental Methods in the Study of Polarization in Electroplating Processes; Deposition of Nickel and Cobalt by Chemical Reduction; Conversion Coatings on Zinc; Barrel Chromium Plating; Bulk Nickel Plating; Bright Brass Plating; Effects of Copper in Nickel Plating Solutions: Extraction Methods Applied to the Analysis of Electroplating Baths—Determination of Impurities in Nickel Plating Solutions; Electroplating Solution Purification; Present Status of Plating Room Waste Disposal; Health Hazards in the Electroplating Industry; Standardization of Buffing for Preparation of Test Panels; Evaluation of the Buffability of Nickel Deposits; Effect of Surface Finishing of Nonferrous Base Metals on the Protective Value of Plated Coatings.

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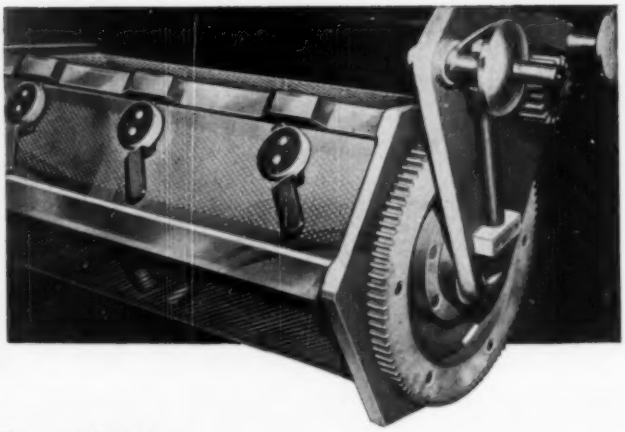

in the NEW BELKE High Temperature LUCITE BARRELS

No more transferring work from barrel to barrel. You load the work once for the whole job — pickling, electro-cleaning, plating and rinsing.

Withstand All Solutions — Give long service in cadmium, nickel, copper, zinc, tin and brass plating cycles *at temperatures to 185°F.*

Molded One-Piece Construction — No panels, ribs or tie rods. No trapping of small pieces to cause rejects and unloading trouble. Faster plating and better quality.

Built for Long Service — Door opening in cylinder reinforced at top and bottom and braced across center for greater strength and to prevent warping. Hangers, gears and bearings of Melamine — No metal exposed to solution except easily replaceable ball contacts.

Other Service-Proved Features

Tight fitting covers with convenient cover locks attached.

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Improved flexible dangler contacts.

Double duty bearings on drive shaft.

Replaceable bushings for long life with low upkeep.

To modernize your plating barrels, BELKE High Temperature Lucite Cylinders can be furnished for any size and style of hanger.

Consult your BELKE Service Engineer for complete information — or write.

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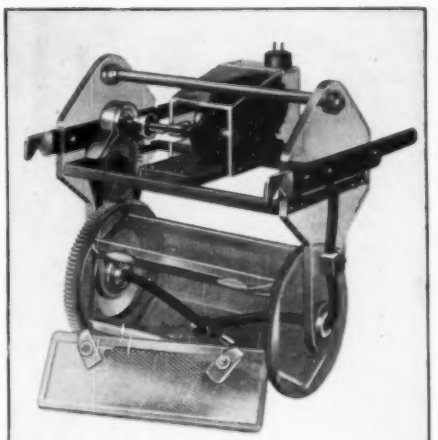

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For Small Odd Jobs

Sets into any still plating tank. Easily transferred by hand — weight only 27 lbs. Capacity is approximately 2 quarts. Molded High Temperature Lucite Construction withstands all cleaning and plating cycles at temperatures to 185°F.

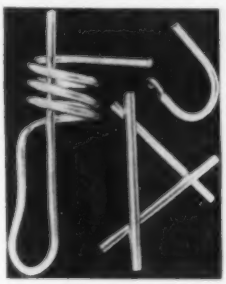
Fast and easy loading and unloading is afforded by clutch that starts and stops cylinder without shutting off motor.

Support arms of Porto-Plater rest across bus rods so cylinder hangs down into plating solution. Uninsulated notched end of support arms contact cathode rod to complete plating circuit. Operated by complete self-contained motor drive with plug connection.

For complete information, consult your BELKE Service Engineer — or write.

Equipment and Supplies

E—520. Chromium Plated Steel Rods—A new type of chromed steel rod providing a bright corrosion-resistant finish suitable for bending, forming, spot welding, butt welding, or swaging without damage to the chromed surface has been announced by the Kenmore Metals Corporation, 380 Ninth Street, Jersey City



2, N. J. Said to be easier to fabricate than stainless and available at relatively low cost, it is particularly well suited for the manufacture of parts for vacuum cleaners, display stands, furniture, bicycles, stove grilles, typewriters, refrigerators, curtain rods, towel bars, shoe racks, and many other formed rod applications.

The rods are supplied, through distributors, in diameters ranging from 11 AWG to 5/16 inch in any commercial length and with nickel and chromium plating to specified thickness. All rods are suitable for the same bending as unplated steel wire or rod of the same diameter. For further information, use Reader Service Card.

E—521. Identification Tape—Labelon, a patented smudge-proof labeling tape, has just been introduced by the Labelon Tape Company, 100 Anderson Avenue, Rochester, N. Y. The pressure sensitive tape is said to be water proof, oil proof, acid resistant, and to withstand temperatures up to 150° F. Made of two sheets of acetate tape with a special carbon material sealed between, identification can not be erased, smudged, or rubbed off.

Packaged in its own dispenser, Labelon is available in 5/8 or 3/4 inch wide 500-inch rolls with blue or black edging. For further information, use Reader Service Card.

E—522. Rubber Pinch Valve—A rubber pinch valve for use in chemical industries has been developed by the mechanical goods division of United States Rubber Company, Rockefeller Center, New York 20, N. Y. The new valve is said to outwear metal when installed in pipelines carrying abrasive or corrosive mixtures. Its flexibility will offset misalignment in pipes. No packing or repacking is required. It absorbs vibration, eliminates "water hammer", and affords positive seal in the closed position. Its metal parts can be refitted to new valve bodies, thereby reducing replacement costs, and it will break up galvanic action in metal lines. For further information, use Reader Service Card.

E—523. Air and Water Rinse Gun—The Technical Equipment Division of Turco Products, Inc., 6135 S. Central Avenue, Los Angeles 1, Calif., recently revealed details of new precision-built air and water rinse gun, in which the air and water systems are controlled separately. Called the "Air and Water Rinser", the new gun uses hot or cold water, connects to a regular air and water supply, has a built-in hang-up hook, is engineered to eliminate troublesome back splash. Built to fit comfortably the operator's hand, the new gun is said to make difficult rinsing easy, almost effortless. The heaviest dirt and grease are said to be blasted from even the finest finish, safely and swiftly.

The rinser is recommended for use in rinsing after application of emulsion precleaners, degreasing solutions, paint strippers, and other cleaning materials. For further information, use Reader Service Card.

E—524. Cleaner—Formula 73, a wartime development for cleaning before and after welding and silver brazing, is now offered by Sully Engineering, Ltd., 11673 San Vincente Boulevard, Los Angeles 49, Calif., for removal of fluxes, heat scale and corrosion products from copper, brass, iron, steel, and stainless steel without any corrosive after-effects. It is said to be nonflammable and nontoxic and to have detergent action. It is sponged onto the surface, agitated with steel wool or cloth, and then removed along with dirt and impurities with a clean cloth. For further information, use Reader Service Card

E—525. Microscope—A wide-field industrial 20-power microscope Model S-186 with stand is now being produced by the Buhl Optical Company, Dept. TP7, Pittsburgh 12, Pa. This is said to be a

rugged shop microscope, particularly valuable where work requires close and accurate checking of details of castings, machined threads, surface finishes, welds, textiles, raw materials, fibers. The microscope may be angled in any direction and raised and lowered to accommodate pieces up to 12 inches in height. For further information, use Reader Service Card.

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A SIGNED STATEMENT by a user of BURNISHALL—No. 720 and STEEL CLEANER—No. 17

"Since using your No. 720 Burnishing Compound, we have found that our burnishing time has been cut to an all-time low and the brilliance of our finish reached an all-time high.

"Parts that have deep recesses covered with drawing oils and compounds have been one of our chief headaches. By the use of your No. 17 Steel Cleaner, these oils and compounds are easily removed and our rejects have been cut to almost nothing. No other cleaner we tried could do this.

"Better quality is our best recommendation.

"The use of these products has enabled us to maintain the highest standard of quality demanded of all Eagle products and at the same time has lowered our overall costs."

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They will do just as good a job for you.

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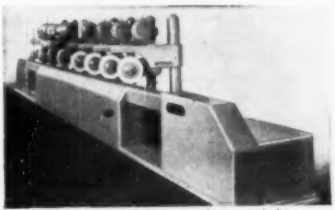
A typical M-W rotary installation—note versatility of compound angle, floating heads.



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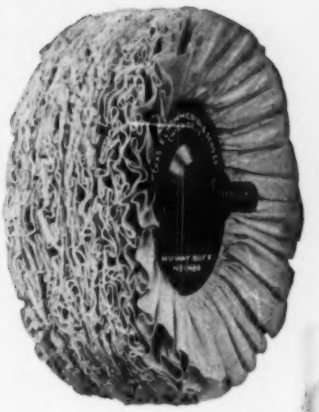

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MORE COMPACT, NO LOSS FROM BREAKAGE, MORE ECONOMICAL.

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TUB CAN BE LIFTED OUT FOR DUMPING AND TUMBLING BARREL INSERTED FOR TUMBLING INSTEAD OF PLATING—VERY RIGID—THREE SPEEDS.

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Equipment and Supplies

E—526. Analytic Instrument—Analytical Measurements, Inc., 585 Main Street, Chatham, N. J., offers the Analascope, an instrument which is said to provide a convenient, dependable means for measuring and continuously showing any phenomenon that can be translated

into electrical impulses, whether static, rapidly fluctuating, or of high or low impedance. One moment it can serve as a *p*H meter which measures to 0.001 *p*H, the next moment as a pressure indicator or a strain analyzer.

Results are displayed on the long-persistence screen of a 5-inch cathode-ray tube. It allows continuous observation of nonrecurrent phenomena at sweep speeds of from 0.01 to 5 seconds. A two-decade precision potentiometer calibrated with a self-contained standard cell provides direct measurements from 0.001 *p*H to 15 *p*H and 0.1 millivolts to 1.5 volts. An input attenuator of 1,000 megohms provides overlapping ranges of 1 micro-micro-ampere to 10 milliamperes and 1 millivolt to 100 volts per centimeter deflection. For further information, use Reader Service Card.

E—527. Testing Abrasion Resistance—A new Taber Abraser for solid materials and coatings, manufactured by Taber Instrument Corporation, 111-PL

Goundry Street, North Tonawanda, N. Y., incorporates the proven Taber rotary rub-wear action of dual abrading wheels crisscrossing their abrasion path. The action is continuous throughout the 360° rotation of the specimen and is said to parallel closely abrasive wear encountered in actual use.

The new Abraser features sturdier shafts and larger ball bearings, a capacitor-type motor with heavy-duty worm-gear drive, extra powerful vacuum unit with dual suction nozzle for high-efficiency pickup of abradings, and electric counter for registering the wear cycles. Three standard ranges of wheel pressures against the specimen, 250, 500 and 1,000 grams, are provided. A variety of holders for different kinds of specimens have been developed, such as the rimmed specimen holder that can be partially filled with a liquid sufficient to wet the specimen or completely cover it while undergoing abrasion test. For further information, use Reader Service Card.

E—528. Pneumatic Liquid Level Transmitter—A new liquid-level pneumatic transmitter has been introduced by Brown Instrument Division, Minneapolis-Honeywell Regulator Company, Wayne and Roberts Avenues, Philadelphia 44, Pa.

The new transmitter, using buoyant force on a partly immersed cylinder, is said to require neither purges nor liquid seals and can be operated for long periods with practically no maintenance. Its sensitivity is one part in 14,000 and its reproducibility ± 1 per cent of full scale. Vibrations will not affect operation, level can be measured in practically any tank or container, and the pressure ratings make the unit suitable for most applications.

The new device is used for differences of level ranging from 14 to 120 inches for liquids of various specific gravities and viscosities. For further information, use Reader Service Card.

E—529. Miniature Controlled-Volume Pumps—At the forthcoming National Chemical Exposition in Chicago, September 5–9, the Milton Roy Company, Philadelphia 18, Pa., will show for the first time a new controlled-volume pump for handling minute quantities of clear liquids in precise volumes at pressures up to 1000 psi. This "miniPump" is available in simplex or duplex types, powered by a 1/20-hp motor, also as a simplex pump powered by a 1½-inch reciprocating air cylinder. The liquid end is the exclusive double-ball-check design. Construction is stainless steel. Plunger stroke length is adjustable during operation from zero to full rated capacity. Ball-checks are available in glass, 440 stainless-steel, or sapphire balls. Maximum capacities vary from 16 to 3740 milliliters per hour, depending upon stroking speeds, stroke lengths, and plunger sizes. For further information, use Reader Service Card.

E—530. Semiplastic Drawing Compound—Northwest Chemical Company, 9310 Roselawn Avenue, Detroit 4, Mich., offers a drawing compound, called "Fluid Film" that keeps its physical properties during stamping of ferrous and nonferrous alloys. A complex, semiplastic mixture, it has high film strength and will not separate under high stress. High free surface energy of its particles gives stability that prevents phase separation.

This drawing compound has high physical and chemical stability and resists atmospheric and other deterioration. It is neutral and can generally be removed with a plain water wash, because it is not pigmented. There is no heavy residue left on the work, nor will it cause staining. It is easily applied by brush, spray, roll, or dip right over mill oils, hence precleaning is unnecessary. For further information, use Reader Service Card.

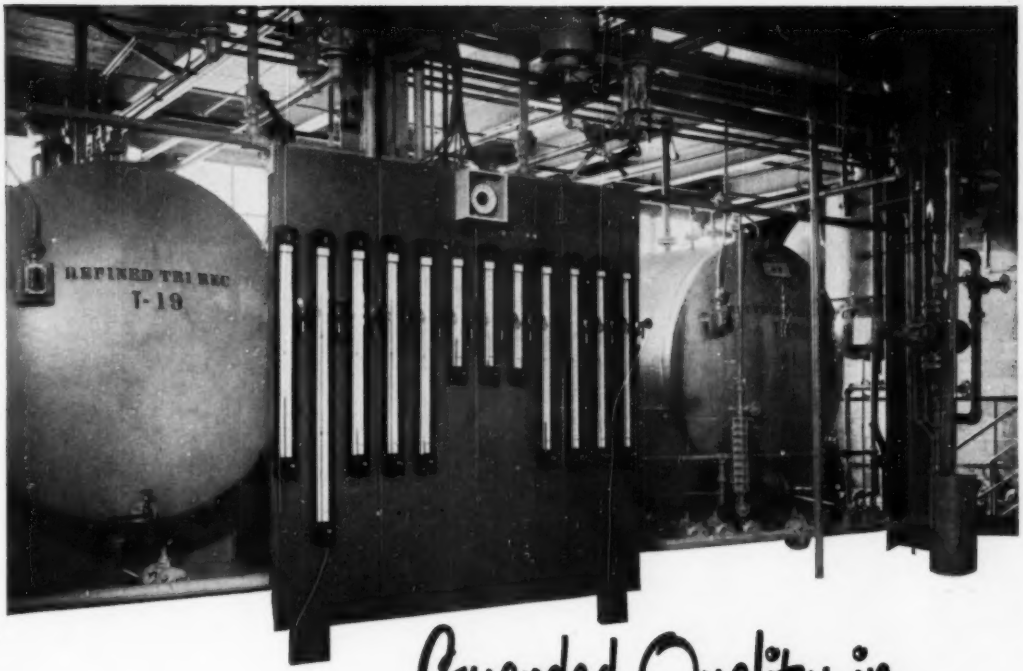
E—531. Drum Liners—Paramount Rubber Company, 10401 Northlawn Avenue, Detroit 4, Mich., now manufactures electronically heat-sealed vinyl drum liners

for plating solutions and storage of corrosive liquids. The top photograph shows a man putting the drum liner in the steel drum, the bottom picture how the liner folds over the top of the drum. Folded and stored on a shelf, it can be installed when needed at a moment's notice. All types of acids and akalies can be used in the drum with a vinyl liner, even nitric acid solutions, it is said. The vinyl is 0.020 inch thick. For further information, use Reader Service Card.

E—532. Oil-Immersed Selenium Rectifier—A new oil-immersion selenium rectifier especially designed for electroplating—particularly barrel plating—has been announced by the General Electric Company's Lighting and Rectifier Divisions.

Believed to be the first standard rectifier using hermetically sealed selenium stacks to withstand the corrosive atmosphere of a plating room, the new unit is available in two models: 6/12-volt, 1500/750-ampere DC output, 230/460-volt, 60-cycle, three-phase AC input; 9/18-volt, 1500/750-ampere DC output, 230/460-volt, 60-cycle, three-phase AC input.

The new rectifier consists of a trans-



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So . . . for a metal-cleaning and degreasing agent of highest quality and stability, order from Niagara.

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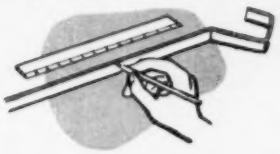

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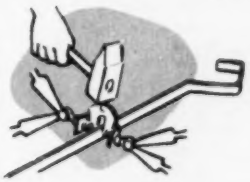

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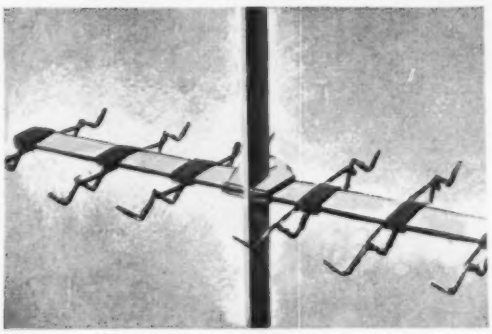

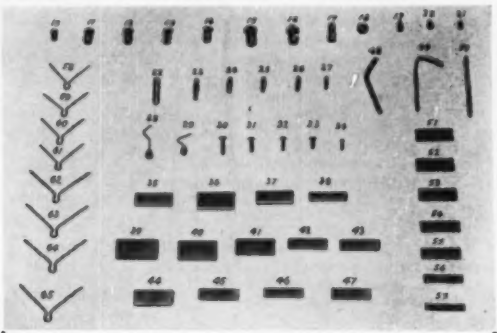

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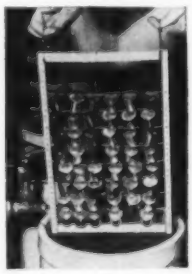
E—535. Ceramic Wiring Frame—American Lava Corporation, 219 Kruesi Building, Chattanooga 5, Tenn., custom makers of technical ceramics, has developed an AlSiMag rack consisting of ceramic bars with tapped holes fastened together with stainless steel screws and supplied with holes through which wires



are passed to hold parts to be plated. The bars can be made in a variety of shapes and sizes and assembled like a child's Tinker Toy. The ceramic has a tensile strength of 10,000 psi, a compressive strength of 85,000 psi, a flexural strength of 20,000 psi, and a resistance to impact (0.5-inch rod Charpy) of 5.0 inch-pounds. It is highly rigid, but being somewhat brittle it requires more careful handling than metal. It is said to be unaffected by plating acids and alkalies. It has found application in the manufacturer's plant for metallizing ceramic parts used for electronic purposes. For further information, use Reader Service Card.

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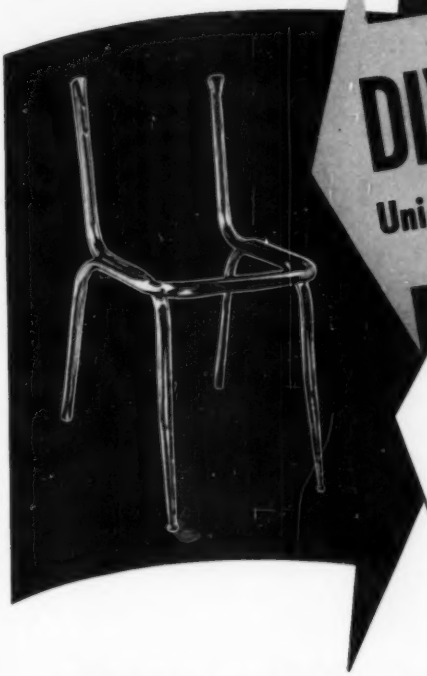

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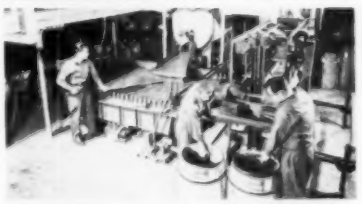

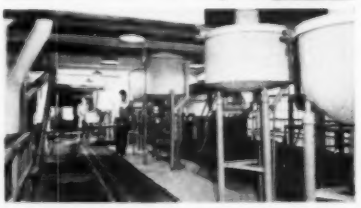

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AUGUST 1950 VOL. 37 NO. 8

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Editorial

Seeing and Disbelieving

SEVERAL YEARS AGO, at the First Industrial Finishing Exposition in Detroit, The International Nickel Company exhibited a number of optical illusions. They showed how grossly one's eyes can be deceived and how necessary it is to use measuring devices to get at the true shape of things.

Technical and scientific literature can easily have a similar illusory effect if one does not watch out. Sometimes the writer gets hypnotized by his own findings and squeezes an unwarranted conclusion out of a meager effect. The reader has an even more difficult time avoiding incorrect conclusions. One may therefore question whether there are any devices which will tell how reliable one's impressions of the written word actually are.

First it should be noted that most experimental work or observations in the shop cover only a limited range of conditions. Unfortunately we are mentally apt to extend these conditions in our minds to a point where they encompass the very range in which we ourselves are interested, even if it was not covered at all in the report. One example may suffice. When a study of true tensile stress in nickel deposits from a Watts bath shows that it increases with solution temperature, one is likely to generalize this finding to include all kinds of nickel baths. It ordinarily would not enter one's mind to vary the chloride content of the bath and find that the aforesaid statement is incorrect when the chloride ion exceeds a certain concentration.

The textbook writer is particularly likely to lead one astray in matters of this kind, because he is forced to condense a great deal of material. It is therefore frequently necessary to go beyond the text and study the original reference in order to arrive at the limitation to a generalized statement.

Many readers have special faith in shop observations because of their "practical" nature. They forget that the shopman's ranges of observations are peculiarly narrow and often ill defined and hence are most likely to be misinterpreted.

The first device to be used, therefore, in reading technical or scientific literature is purely mental: to define consciously the ranges of observations, and know that the further one extends the application of the conclusion beyond the experimental range, the greater becomes the gamble.

In the next issue we will deal with a different kind of illusion and find again the need for disbelieving what we see.

Gustaf Soderberg

THE STRENGTH AND DUCTILITY OF ELECTRO-DEPOSITED METALS

II. Some Data on Acid-Copper Deposits*

THOMAS A. PRATER†
and HAROLD J. READ‡

In this installment the authors present some data on tensile strength and ductility of commercially produced thin electrolytic copper sheet. They show variability in as-plated sheet of about 40,000–48,000 psi tensile strength and 0.013–0.047 significant strain at fracture and in annealed sheet of about 26,000–37,000 psi tensile strength and 0.17–0.32 significant strain at fracture. The authors' main concern is with the reproducibility of the results of the bulge test. Satisfactory reproducibility is indicated by the fact that the stress-strain data fall on smooth curves which are very similar to the flow curves obtained in the conventional tension test. Best agreement between duplicate runs was obtained with the thinner deposits, probably because of more uniform thickness. No effect of coating thickness was observed in the range investigated, 0.66–3.6 mils. Anisotropy was encountered as an effect of directional base-metal treatment, but it was concluded that it does not affect seriously the validity of the bulge-test method.

Introduction

The first paper of this series[1] described the procedure whereby data obtained from the hydraulic bulge test may be used to determine the strength and ductility of thin electrodeposits in terms which are comparable to those used in describing the results of the simple tension test. The apparatus and experimental procedure for obtaining bulge test data were also described. It is now desirable to present some actual results which show what can be done with the method. We shall not be so much concerned for the moment with data of engineering or design importance as we shall be with the interpretation of results and the determination of the reproducibility.

Since most electrodeposits are comparatively brittle, it is particularly important to determine the sensitivity of the bulge test for the measurement of quite small strains.

It is obvious that experiments which are carried out to determine the reproducibility of a test must be performed on specimens which have identical properties. It is difficult, at least on a laboratory scale, to electrodeposit enough specimens for reproducibility studies and still be certain that minor variations in bath com-

*It is anticipated that the material presented herein and in succeeding papers will be incorporated into a thesis to be submitted by Thomas A. Prater in partial fulfillment of the requirements of the degree of Doctor of Philosophy in Metallurgy.

†Instructor, Division of Metallurgy, Pennsylvania State College, State College, Pa.

‡Associate Professor, Division of Metallurgy, Pennsylvania State College, State College, Pa.

position and operating conditions from one run to the next have not introduced significant variations in the properties of the deposits. It was thought that at least 10 and preferably 20 specimens should be available for a single reproducibility experiment—one half to be tested in the as-plated condition and the other half after annealing. Since facilities were not available to prepare a single sheet large enough to provide so many specimens, recourse was had to a commercial product. Electroformed copper sheet may be obtained in a variety of thicknesses and in sheets large enough to supply an abundance of specimens which were plated under extremely uniform conditions.

Experimental Details

The electroformed copper sheet, which was made available to us through the courtesy of Mr. S. Skowronski of the Raritan Copper Works, Perth Amboy, N. J., was deposited from a solution containing 45 g/l (6 oz/gal) of copper and 200 g/l (27 oz/gal) of sulfuric acid. Glue was used as the addition agent. The apparatus and some details of operation employed in the manufacture of the sheet material have been described by Shakespeare[2].

All specimens of a given thickness were taken from a single large sample of the electroformed sheet, and both the orientation and relative location of each specimen was recorded. The thickness of each specimen was determined by weighing the test disc and calculating the thickness from the weight and area and the density of copper (taken as 8.9 g/cm^3).

Experimental Results and Discussion

Strain distribution in the bulge

Since the strain is not uniform over the entire surface of a hydraulically formed bulge, it is necessary to study the distribution of the strain or at least to know the magnitude of the maximum strain which corresponds to a given deflection at the center of the bulge. The latter approach is the simpler one. Membrane theory predicts that the maximum deformation will be obtained at the top of the bulge. In order to verify this point, 20-line-per-inch photo grids were printed on several specimens of electrolytically deposited copper which had been annealed for 0.5 hr at 1200° F (648° C). The annealing was necessary in order to obtain the ductility required for the experiments. These specimens were then deformed into bulges by means of the hydraulic tester described in Part I[1]. The strain was measured over the entire surface of the bulges. The results were found to conform with those expected, i. e., the strain varied from zero at the clamped edge to a maximum at the dome of the bulge. It was also noted that the strain was nearly constant over a relatively large area near the top of the bulge.

After this had been established experimentally, the next step was to study the relationship existing between the height of the dome of the bulge and the strain. This was done for electrodeposited sheet copper which had been annealed for 0.5 hour at 1200° F (648° C). Deposits of two thicknesses, 3.6 mil (0.094 mm) and 0.66 mil (0.017 mm), were employed for this purpose. Photo grids were printed on a number of such annealed deposits which had been cut into circular specimens 2.4 inches (61 mm) in diameter. Each of these was then placed in the tester and deformed to some predetermined center deflection ranging from 0.1 to 0.4 inch (2.5 to 10 mm). After deformation, the specimen was removed from the tester, and the distances between the lines of the photo grid were measured with a microcomparator at the topmost portion of the bulge. The significant strain ($\bar{\delta}$) was then calculated from the equation

$$\bar{\delta} = 2\delta_1 \qquad (1)^*$$

where

$$\delta_1 = \ln \frac{l}{l_o} \qquad (2)$$

In this equation l_o is the original distance between grid lines, namely, 0.05 inch (1.27 mm) and l is the distance between grid lines after deformation.

The data obtained in these tests are plotted in Fig. 1. It must be emphasized that this relationship will be different for a tester with different dimensions and may vary with the material being tested. The curve clearly indicates that very small strains result in relatively large deflections whereas further increases in strain result in much smaller increases in deflection. This emphasizes the usefulness of the bulge test in comparing ductilities of materials capable of undergo-

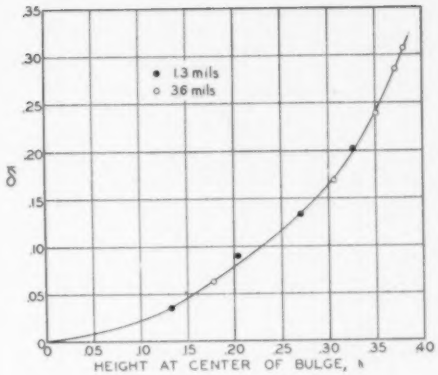

Fig. 1. This plot indicates that the relationship between significant strain and the height of the bulge is not a function of thickness

*The derivations of this equation and of subsequent equations employed in this paper were presented in Part I[1].

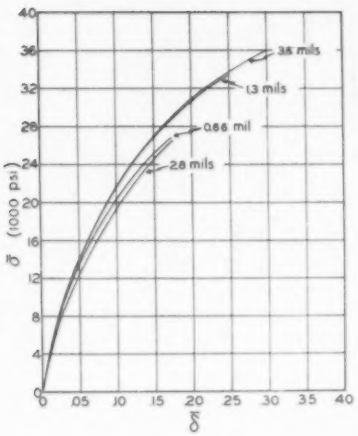

Fig. 2. Flow curves for acid-copper deposits of four thicknesses. The termination of each curve is at the fracture stress

ing only limited deformations. It is also evident that the relationship is independent of specimen thickness, at least within the limits of thickness investigated.

Reproducibility studies

After the relationship between the center deflection of the bulge and the strain had been established, a study of reproducibility of results obtained by this test method was undertaken. Four groups of specimens were used in the investigation, namely, (1) 0.66 mil (0.017 mm) acid copper, as-plated; (2) 0.66 mil (0.017 mm) acid copper, annealed for 0.5 hour at 1200° F (648° C); (3) 3.6 mil (0.094 mm) acid copper, as-plated; and (4) 3.6 mil (0.094 mm) acid copper, annealed for 0.5 hour at 1200° F (648° C). Seven or more specimens of each type were tested, and the significant stress and significant strain to fracture were calculated from the experimental data. These data are tabulated in Table I. In every specimen except one the failure occurred fairly near the top of the bulge where the strain is a maximum. In specimen "3b", however, the fracture occurred as a tear along the inside edge of the clamp-down ring. It is believed that this was occasioned by the presence of a thin area in the original specimen. If the data obtained in this particular test are discarded because the failure occurred in an area where the strain was not a maximum (unless the original thickness of the specimen varied from point to point) it is seen that the reproducibility is quite good. In the case of the as-plated specimens, the maximum variation from the average fracture stress ($\bar{\sigma}$) is about 5.5 per cent for both the 3.6 mil (0.094 mm) and the 0.66 mil (0.017 mm) copper. For the annealed specimens the reproducibility is somewhat poorer. The 0.66 mil (0.017 mm) copper showed a maximum deviation from the average value

TABLE I. REPRODUCIBILITY STUDIES ON ELECTROFORMED COPPER

Thickness: 0.66 mil (0.017 mm)

As-plated			Annealed 0.5 hr at 1200° F		
Spec. No.	$\bar{\sigma}$ psi	$\bar{\delta}$	Spec. No.	$\bar{\sigma}$ psi	$\bar{\delta}$
A	50,300	0.014	B	26,400	0.166
C	49,400	0.012	F	26,500	0.182
E	49,700	0.013	J	25,600	0.181
G	45,200	0.010	L	27,000	0.185
I	46,100	0.012	N	28,400	0.192
K	47,100	0.013	O	28,300	0.199
M	49,400	0.017	W	25,100	0.165
O	46,100	0.013			

Thickness: 3.6 mil (0.094 mm)

As-plated			Annealed 0.5 hr at 1200° F			
Spec. No.	$\bar{\sigma}$ psi	$\bar{\delta}$	Spec. No.	$\bar{\sigma}$ psi	Center Deflection inch	$\bar{\delta}$
3b	46,600	0.055	3a	34,800	0.374	0.292
3d	42,000	0.047	3c	36,700	0.391	0.333
3g	42,400	0.050	3e	40,500	0.409	.....
3i	39,700	0.046	3f	37,800	0.398	0.352
3k	39,400	0.037	3h	34,800	0.376	0.297
3m	38,100	0.057	3j	41,000	0.415	.....
3o	40,100	0.043	3l	34,300	0.408	.....
			3n	36,700	0.381	0.309

of about 6.3 per cent and the 3.6 mil (0.094 mm) copper a maximum variation of about 10.5 per cent. The strains to fracture also show good reproducibility. In the as-plated specimens, where the strain to fracture is very small, the significant strain values ($\bar{\delta}$) vary from 0.010 to 0.017 for the 0.66 mil (0.017 mm) copper and from 0.037 to 0.057 for the 3.6 mil (0.094 mm) copper. When these values are expressed in terms of per cent elongation in a tensile test* the equivalent values are 0.5 to 0.9 per cent for the 0.66 mil (0.017 mm) copper and 1.9 to 2.9 per cent for the 3.6 mil (0.094 mm) copper. In the annealed condition, where the material showed much greater ductility, the $\bar{\delta}$ values for the 0.66 mil (0.017 mm) copper vary from 0.165 to 0.199, equivalent to 8.6 to 10.5 per cent elongation in simple tension. The height of bulge obtained in testing the annealed 3.6 mil (0.094 mm) copper was in some cases greater than the maximum for which the center deflection *vs.* significant strain (h *vs.* $\bar{\delta}$) relationship has been established. For this reason the strains obtained in testing this material are reported in terms of center deflection to fracture. Here again the reproducibility is quite good. It is obvious from these results that the reproducibility in terms of ductility is at least as good as is commonly obtained in a simple tension test.

The applicability of the bulge test to the determination of the flow characteristics of a thin electrodeposit is illustrated in Figs. 2, 3, and 4. Flow curves ($\bar{\sigma}$ *vs.* $\bar{\delta}$) were obtained for annealed electrodeposited copper of four thicknesses, namely, 0.66 mil (0.017 mm), 1.3 mil (0.033 mm), 2.8 mil (0.071 mm) and 3.6 mil (0.094 mm)†. These curves were obtained by the procedure outlined in the first installment of this paper. The first step in this construction is to obtain simultaneous readings of pressure, P, and height of bulge, h, at frequent intervals during the deformation of the specimen. Values of the significant strain corresponding to any value of h can be obtained directly from Fig. 1. The calculation of significant stress for any pressure, P, from the equation

$$\bar{\sigma} = \frac{PR}{2t_i} \tag{3}$$

requires that the radius of curvature, R, and the instantaneous thickness of the specimen, t_i, be known. If h is known, R can be calculated from the relationship

$$R = \frac{r^2 + h^2}{2h} \tag{4}$$

where r is the radius of the opening through which the bulge is blown.

The instantaneous thickness, t_i, can be established in the following manner:

Since $\delta_3 = (\delta_1 + \delta_2) = -2\delta_1$ (5)

and $\bar{\delta} = 2\delta_1$ (6)

$\bar{\delta} = -\delta_3$ (7)

and since from Equation 2

$$\delta_3 = \ln \frac{t_i}{t_o} \tag{8}$$

$$\bar{\delta} = \ln \frac{t_o}{t_i} \tag{9}$$

$$\frac{t_o}{t_i} = e^{\bar{\delta}} \tag{10}$$

$$t_i = \frac{t_o}{e^{\bar{\delta}}} \tag{11}$$

Making such calculations for many points on a flow curve is time consuming; hence, it is advantageous to use graphical methods of obtaining t_i values. The

*The relationship between $\bar{\delta}$ and percent elongation can be established as follows:

$$\delta_1 = \frac{\bar{\delta}}{2}$$

and

$$\delta_1 = 2.3 \log \frac{l}{l_o}$$

hence

$$\frac{l}{l_o} = \text{antilog} \frac{\delta_1}{2.3} = \text{antilog} \frac{\bar{\delta}}{4.6}$$

Since per cent elongation is defined as

$$\%\ \text{elong} = \left(\frac{l}{l_o} - 1 \right) 100$$

then

$$\%\ \text{elong} = \left(\text{antilog} \frac{\bar{\delta}}{4.6} - 1 \right) 100$$

This relationship in simple tension is valid only so long as the elongation in simple tension is distributed uniformly over the gauge length. Once necking has set in, the relationship holds only if the elongation in simple tension is measured over an infinitesimal gauge length at the point of maximum deformation. Since this is *not* the type of measurement referred to in typical engineering expressions, such as per cent in a 2-inch gauge length, the values reported here should not be compared with elongation values reported in such terms. Because of the artificiality of the engineering expressions, the authors prefer to use $\bar{\delta}$ at fracture as the measure of ductility.

†Annealed deposits were used for these experiments because no as-plated deposits having enough ductility to provide an interesting flow curve were available. There is no reason to believe that equally good curves could not be obtained on ductile as-plated deposits if and when they are encountered.

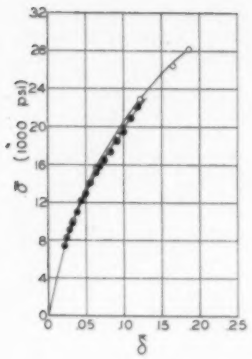

Fig. 3. Flow curves for 0.66 mil (0.017 mm) acid-copper deposits. The termination of each curve is at the fracture stress

curves necessary to accomplish this and the method of applying them were described in Part I[1]. The curve employed in routine calculations relates the ratio $\frac{t_i}{t_o}$ to height at center of the bulge. This plot is useful for calculating the instantaneous thickness of specimens of any original thickness. The values of R and t, obtained by means of curves are used to calculate the significant stress in accordance with equation 3.

Flow curves for four different thicknesses of material are plotted in Fig. 2. The curve for each thickness is the average curve of two tests except in the case of the 1.3 mil (0.033 mm) copper. It is seen from these curves that the stress required for a given deformation is not greatly influenced by thickness; in fact, it is quite likely that the slight divergence of the curves from one another is caused by structural variations

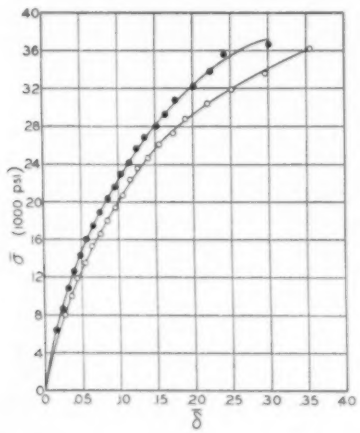

Fig. 4. Flow curves for 3.6 mil (0.094 mm) acid-copper deposits. The termination of each curve is at the fracture stress

rather than by a simple thickness effect. The agreement between the behavior of different specimens of the same thickness was very good. This was especially true in the case of the 0.66 mil (0.017 mm) and the 2.8 mil (0.071 mm) materials. The data for the two specimens of 0.66 mil (0.017 mm) copper are plotted in Fig. 3. The poorest agreement was obtained in the testing of the 3.6 mil (0.094 mm) deposits, but even here the stress required to cause a given strain differs by less than 10 per cent. Data for two specimens of 3.6 mil (0.094 mm) thickness are plotted in Fig. 4. The accuracy with which the individual points of a given test lie on the flow curves gives the best indication of the precision of the measurements, and the difference in the two tests is believed to be caused by an actual difference in the behavior of the two specimens.

There is reason to believe that thickness variations are relatively greater in the 3.6 mil (0.094 mm) copper than in the 0.66 mil (0.017 mm) deposits; hence, there is a greater probability that flow curves for the former might be in poorer agreement than for the thinner material. Much more emphasis should be placed both on the smoothness of the individual curves and on their close agreement in form to those obtained in the conventional tensile test than upon coincidence of two curves for *supposedly* identical specimens. Experience has indicated that it is extremely difficult to prepare electrodeposited specimens which are identical in mechanical properties.

It will be noted in Table I that the significant stress necessary to cause fracture of the 3.6 mil (0.094 mm) copper was only slightly decreased by annealing, whereas in the 0.66 mil (0.017 mm) deposits the decrease was nearly 45 per cent. The microstructures of these materials were studied in an effort to determine the reason for this apparent anomaly. It was discovered that in each case the annealing had resulted in a rather marked grain-growth. The grain size was such that in the thinner material the thickness of the specimen was of the same order of magnitude as the average grain diameter. This resulted in only a few grain boundaries across the thickness of the specimen, and hence, a marked decrease in resistance to deformation. In the 3.6 mil (0.094 mm) material, the annealing had caused the same amount of grain coarsening. In this case, however, since the grain size was approximately the same as in the thinner material, several grains were necessary to comprise the specimen thickness. The greater number of grain boundaries caused increased restraint to deformation. In view of this it is not surprising that the strength of the thicker material was less influenced by annealing than that of the thinner material.

General remarks

It may be of interest to discuss briefly the nature of the fractures obtained in the tests. The as-plated specimens broke with a slightly jagged tear which usually fell on or near the diameter of the specimen.

(*Continued on page 850*)

Determination of Free Cyanide and Ammonia in Brass and Bronze Plating Baths

Part II. Experimental Evaluation of Present Methods and Recommended Procedures for Free Cyanide Determination

SAMUEL HEIMAN

Chief Chemist, Philadelphia Rust-Proof Company, Philadelphia, Pa.

(Continued from July issue)

C. FURTHER STUDY OF DIRECT TITRATION METHODS

As seen in section B, the value for free sodium cyanide obtained by the experimental direct-titration method is greatly affected by several variables in both bath composition and analytical procedure. The broad purpose of the work in this section was to ascertain the basic reasons for these wide variations in results and to gain further insight into the chemistry of the analytical reactions and possibly of the complexes present in the bath at the end of the titration. Specifically, these ends could be accomplished by isolating the effects of the above-mentioned variables upon the copper and zinc constituents of the brass bath.

Experimental

A brass bath is essentially a solution of copper cyanide and zinc cyanide complexes. Hence, the experimental work described in section B was repeated with the copper and zinc components of bath B, both with and without sodium carbonate. The compositions of these solutions are given in Table V, the results in Figs. 4–7.

Discussion of Results

The effect of each variable will be considered by comparing its curve in Fig. 2 with its curves in Figs. 4–7.

Potassium Iodide—All curves are substantially flat in the range of 1–2.5 g potassium iodide. The flat portion falls slightly below the broken line for $Na_2Cu(CN)_3$ in Figs. 4 and 5, even less below the broken line for $NaZn(CN)_3$ in Fig. 6, but some 2.2 oz/gal free cyanide above the same broken line in Fig. 7. This compares with a position about 3.7 oz/gal free cyanide above the broken line for $Na_2Cu(CN)_3$ and $NaZn(CN)_3$ for brass bath B in Fig. 2. It is apparent that the effect in the brass bath is largely one of interaction between the carbonate and the zinc cyanide complex, of which more below.

Like in brass bath B, the endpoints in the two zinc solutions B-3 and B-4 were indistinct with 0.2 g potassium iodide, whereas the two copper baths gave sharp endpoints with only 0.1 g potassium iodide. The high free-cyanide values in brass bath B at high iodide concentrations are duplicated only in the two copper baths.

Water—The dilution effect in the titration of brass bath B is reproduced only in the carbonate-containing zinc bath B-4. It is evident that dilution increases the free cyanide content by virtue of its influence on a reaction between the sodium carbonate and the zinc cyanide complex and that removal of the carbonate would eliminate the dilution effect.

Temperature—The effect of titration temperature in raising the value for free cyanide in brass bath B

TABLE V. BATH COMPOSITIONS

	Brass Bath	Copper Bath		Zinc Bath	
	B g/l	B-1 g/l	B-2 g/l	B-3 g/l	B-4 g/l
Constituents	Makeup				
Copper Cyanide	31.5	31.5	31.5	....	....
Zinc Cyanide	11.5	....	....	11.5	11.5
Sodium Cyanide	50.5	44.6	44.6	20.2	20.2
Sodium Carbonate	30.0	....	30.0	....	30.0
	Analysis				
Copper	22.60	22.73	22.73	....	....
Zinc	6.31	....	....	6.30	6.30
Total Sodium Cyanide	73.10	61.84	61.84	28.17	28.17

(Fig. 2) is found in the two copper baths B-1 and B-2 (Figs. 4 and 5) and in the carbonate-containing zinc bath B-4 (Fig. 7), but hardly in the carbonate-free zinc bath B-3 (Fig. 6). As a matter of fact the effect in the brass bath equals the sum of the copper-bath and the carbonate-containing zinc-bath effects. One must conclude that increased temperature causes dissociation of the copper cyanide complex into lower complex and free cyanide and that it promotes a reaction between the sodium carbonate and the zinc cyanide complex whereby sodium cyanide is liberated.

The need for standardization of titration temperature, not only for brass baths but also for copper cyanide baths, is emphasized.

Sodium Carbonate—The increase in the value for free sodium cyanide in brass bath B with increasing sodium carbonate content (Fig. 2) is duplicated only with zinc bath B-3 (Fig. 6) and evident in the generally higher level of free-cyanide values in the carbonate-containing zinc bath B-4 (Fig. 7). This change, then, can best be explained by assuming a reaction between the zinc cyanide complex and the carbonate to give sodium zincate, sodium bicarbonate, and more free cyanide:

$$Na_2Zn(CN)_4 + (2n + 2)\ Na_2CO_3 + (n + 1)\ H_2O = (Na_{2n}ZnO_{n+1}) + 1 + (2n + 2)\ NaHCO_3 + 4NaCN$$

The formation of sodium bicarbonate should be accompanied by a reduction in alkalinity, and such was indeed found on addition of sodium carbonate to a sample of bath B, as shown in Table VI.

It will be noted that the free cyanide values for carbonate-free brass bath B and zinc bath B-3 do not fall at the value these baths would have if the zinc complex were $NaZn(CN)_3$. Hence there is no reason to accept the formula $NaZn(CN)_3$ as being the actual complex in solution, as was done by Pan[29,30]; it is merely a mathematical concept, useful in calculating the makeup of a brass bath with a desired free cyanide content.

Sodium Hydroxide (pH)—The effect of sodium hydroxide additions noted for brass bath B (Fig. 2) also appears for zinc baths B-3 and B-4 (Figs. 6 and 7)

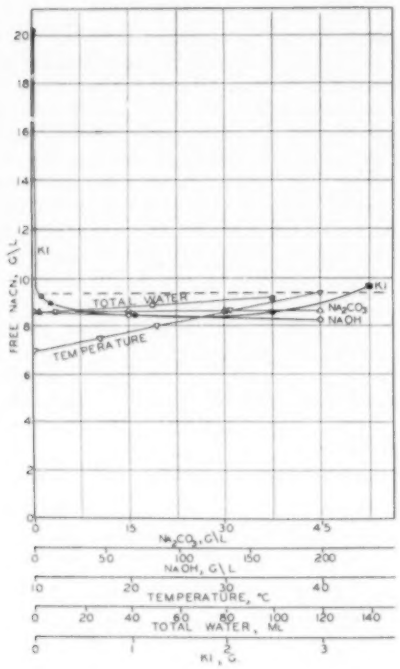

Fig. 4. Effect of amount of potassium iodide, added water and temperature in the titration of sodium carbonate and sodium hydroxide contents of the plating bath on the free-cyanide values for copper bath B-1 (Table V) obtained by the experimental direct-titration method (p. 746). The broken line refers to the free-cyanide value calculated on the assumption of copper cyanide complex $Na_2Cu(CN)_3$

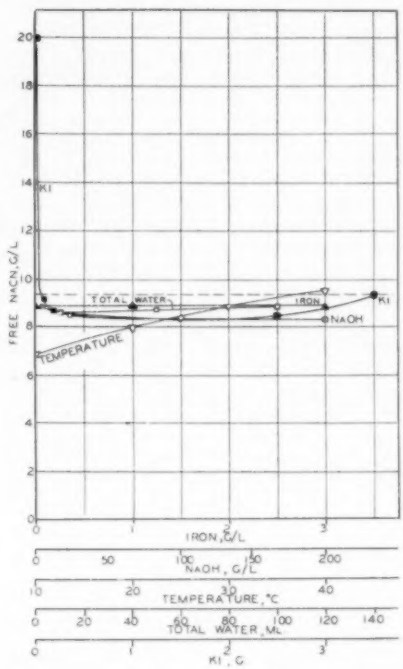

Fig. 5. Effect of amount of potassium iodide, added water and temperature in the titration and of sodium carbonate, sodium hydroxide and iron contents of the plating bath on the free-cyanide values for copper bath B-2 (Table V) obtained by the experimental direct-titration method (p. 746). The broken line refers to the free-cynaide value calculated on the assumption of copper cyanide complex $Na_2Cu(CN)_3$

but not for copper baths B-1 and B-2 (Figs. 4 and 5). This confirms the previous statement in section B that this effect in the brass bath is purely a matter of displacement of sodium cyanide from the zinc cyanide complex with formation of sodium zincate.

Iron—Additions of ferrocyanide, which had a strong depressing effect on the free cyanide values for brass bath B (Fig. 2) and made the endpoints less reliable, had precisely the same effect in zinc bath B-4 (Fig. 7) but no effect in copper bath B-2. This again confirms the statement in section B that the early endpoints may be caused by the slow formation of an insoluble white sodium zinc iron-cyanide compound.

Conclusion

The findings in sections B and C suggest that values for free sodium cyanide may be obtained that are independent of bath and method variables when carbonate is precipitated from and 1 g/l iron (as potassium ferrocyanide) is added to the bath samples and when the titration is carried out at a standardized temperature. The details of this preferred method are given in the final summary.

TABLE VI. EFFECT OF CARBONATE ADDITIONS TO BRASS BATH B ON ITS pH

Na_2CO_3 g/l	*p*H electrometric
0	11.08
15	10.95
30	10.95
60	10.85

It should be noted that the free-cyanide values obtained by this method do not agree with any particular formulas for the copper or zinc cyanide complexes.

D. STUDY OF INDIRECT TITRATION METHODS

In the indirect-titration methods which have been proposed[88,87], the zinc is eliminated as a factor by adding an excess of sodium hydroxide and titrating both the free cyanide and the sodium cyanide which has been expelled from the zinc cyanide complex.

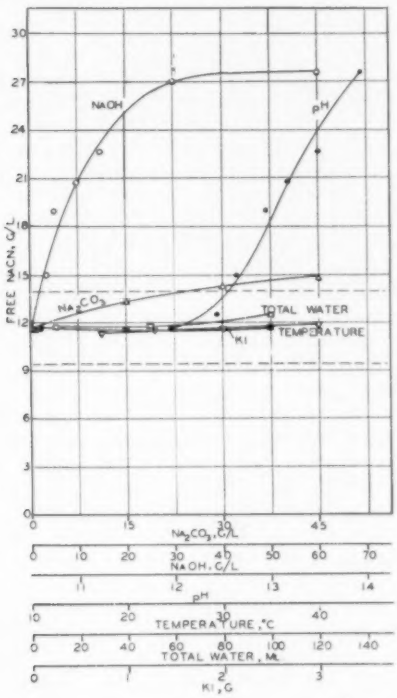

Fig. 6. Effect of amount of potassium iodide, added water and temperature in the titration and of sodium carbonate and sodium hydroxide (pH) contents of the plating bath on the free-cyanide values for zinc bath B-3 (Table V) obtained by the experimental direct-titration method (p. 746). The broken lines refer to free-cyanide values calculated on the assumptions of zinc cyanide complexes $NaZn(CN)_3$ (top) and $Na_2Zn(CN)_3$ (bottom)

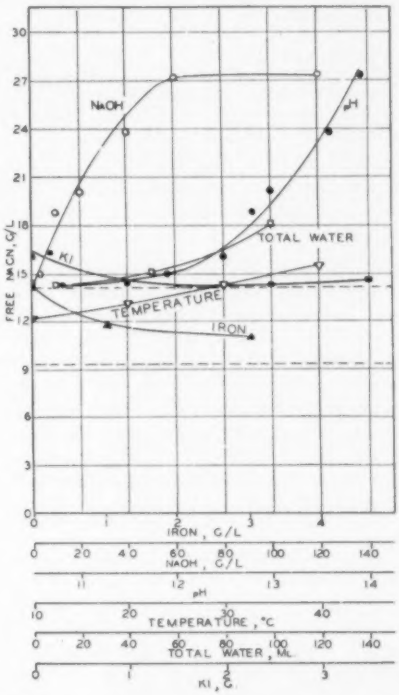

Fig. 7. Effect of amount of potassium iodide, added water and temperature in the titration and of sodium carbonate, sodium hydroxide (pH) and iron contents of the plating bath on the free-cyanide values for zinc bath B-4 (Table V) obtained by the experimental direct-titration method (p. 746). The broken lines refer to free-cyanide values calculated on the assumptions of zinc cyanide complexes $NaZn(CN)_3$ (top) and $Na_2Zn(CN)_4$ (bottom)

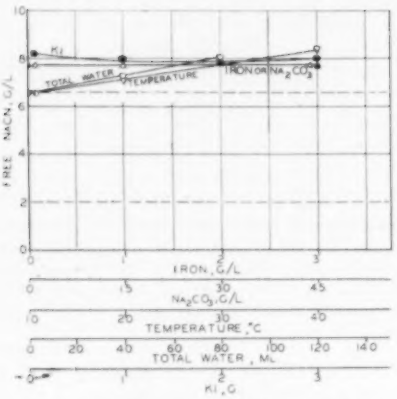

Fig. 8. Effect of amount of potassium iodide, added water and temperature in the titration and of the sodium carbonate and iron contents of the plating bath on the free cyanide values for brass bath B (Table V) obtained by Heiman-McNabb indirect-titration method (Table II) on the assumption that the cyanide complexes are $Na_2Cu(CN)_3$ and $NaZn(CN)_3$. The broken lines refer to the free-cyanide values obtained by Coats calculation method on the assumption that the cyanide complexes are $Na_2Cu(CN)_3$ and $NaZn(CN)_3$ (method 7, top) and $Na_2Cu(CN)_3$ and $Na_2Zn(CN)_4$ (method 7a, bottom)

After the latter value has been calculated from the zinc content, the free cyanide may be found by difference.

Experimental

The experimental work was carried out with bath B using the Heiman-McNabb method described in Table II of Part I of this paper. The effect of changes in the titration method and in composition of the brass bath described in Section B were studied. The results are given in Fig. 8. The broken lines give the calculated values for free sodium cyanide on the assumptions that the copper and zinc complexes are $Na_2Cu(CN)_3$ and $NaZn(CN)_3$ (top line) and $Na_2Cu(CN)_3$ and $Na_2Zn(CN)_4$ (bottom line).

Discussion of Results

It is seen that the value for free cyanide in the brass bath obtained by the indirect method changes relatively little with changes in the potassium iodide concentration, dilution, or temperature in the titration or with variations in the sodium carbonate or iron contents of the brass bath. This was to be expected, because the indirect method is essentially equivalent to the titration of free cyanide in copper plating baths (Figs. 4 and 5).

During the course of this work the titration variables were evaluated with regard to sharpness of the endpoint and economy of materials. On the basis of these criteria, the following amounts would be recommended in a preferred indirect-titration method on a 5-ml sample: sodium hydroxide, 2 g, added as 10 ml of a 20 per cent solution; potassium iodide, 1 g, added as 10 ml of a 10 per cent solution; and water, 20 ml.

In the indirect method, it is necessary to know the formula of the zinc cyanide complex present in the brass bath in order to calculate the free sodium cyanide. The compound $Na_2Zn(CN)_4$ is the only stable zinc cyanide complex; the compound $NaZn(CN)_3$ is relatively unstable and has not been isolated. Consequently, the former formula has been used before.

The data presented in this article indicate, but do not necessarily prove, that in a normal brass bath containing sodium carbonate most of the zinc is present as $Na_2Zn(CN)_4$ in equilibrium with definite amounts of sodium zincate and sodium cyanide. The net result is that, for calculation purposes only, the zinc may best be considered to exist as $NaZn(CN)_3$. On this basis, the values for free cyanide by the indirect methods are close to those obtained on iron-free brass baths by the Blum-and-Hogaboom method.

E. SUMMARY

1. There are several methods in the literature for the analysis of free sodium cyanide in brass plating baths. Since no one method is generally accepted as a standard, considerable confusion has resulted.

2. Six methods now in general use have been evaluated on four brass baths. The value for free cyanide in a given brass bath differed greatly with the method used. The differences were greater in the brass baths with the higher zinc contents.

3. The value for free cyanide found in a given brass bath by any previously known direct-titration method is considerably affected by the sodium carbonate, sodium hydroxide and iron contents of the bath and by the amount of potassium iodide indicator, the dilution of the sample and the temperature employed in the titration.

4. These variations in free-cyanide values were found to be caused almost entirely by the instability of the zinc cyanide complex. The copper cyanide complex, on the contrary, is much more stable. In a copper bath the direct-titration method gives as free cyanide the amount of cyanide in excess of the cyanide in the formula $Na_2Cu(CN)_3$, and this value is substantially unaffected by all the variables listed except titrating temperature.

5. All of the previously known direct-titration methods have the serious drawback that the presence of iron, which is normally found in commercial brass baths, gives low values for free cyanide. In addition, the iron makes for somewhat slow and indistinct endpoints, which reduces the reproducibility.

6. An improved and preferred direct-titration method was obtained by removing the carbonate, adding a small amount of iron to the bath sample, and titrating at a standard temperature. This method is as follows: Measure with a graduate 50 ml of the brass bath into a 500-ml beaker; add 200 ml 0.5-*M*

(*Continued on page 855*)

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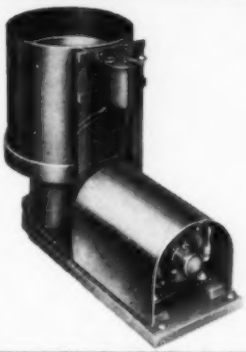

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ALKALINE METAL CLEANING COMPOUND SPECIFICATIONS

A. MANKOWICH
Darlington, Maryland

Introduction

To many users of alkaline metal-cleaning compounds, the procurement of these products brings to mind either brand-name purchasing or compounding of formulations which past experience has associated with definite cleaning jobs. Each of these procedures may be the correct one under certain conditions. The small shop is undoubtedly well advised in obtaining reputable brand-name cleaners. And the somewhat larger organization with more facilities and personnel cannot be criticized if, at times, it finds it economically advantageous to compound cleaners to its own formulae. Except in a very limited sense, neither of the preceding consumers obtains his cleaners by purchase specification. An appreciable section of the metal finishing industry is thus probably not familiar with the various types of cleaning-compound specifications used by larger organizations. It is the purpose of this article to discuss the various types, indicating their advantages and disadvantages. In addition, some reasons for the trend from the composition-properties type to the laboratory-performance type of cleaner specification will be given.

Types of Specifications

Composition Type.—In this type, the percentage of each component in the product is specified. Few metal-cleaning specifications belong to this category, because it is usually found advantageous to include one or more physical- or chemical-property requirements, thus placing the specification in another group. An example of a straight composition-type specification for the procurement of cleaning compound intended for use as a heavy duty, soak tank cleaner for ferrous alloys is the following:

"The compound shall be a homogeneous, free-flowing mixture conforming to the following percentage composition by weight:

Sodium hydroxide	40
Sodium metasilicate pentahydrate	40
Trisodium phosphate monohydrate	15
Synthetic surface-active agent	5."

To this composition requirement may be added others specifying the range of the silica, phosphorus pentoxide, and total-alkalinity contents. In addition, the test methods to be used in making the chemical analyses may be described in detail if believed necessary to avoid disputes between supplier and the purchaser. It is obvious that the purchaser must have the services of a laboratory to obtain full benefit from specification procurement. By the use of this type of specification, the purchaser should obtain the same product that he formerly used and again wants.

Composition-properties Type.—This type includes various physical and chemical property requirements in addition to the specified composition. Factors that have been used as property requirements in cleaning-compound specifications are: solubility, available alkalinity, *p*H, corrosiveness to various alloys, buffer capacity, rinsability, dusting, surface tension, foaming, deflocculation, granulation, cleaning properties, and water-softening power. Some of these property requirements are applicable to all types of alkaline cleaning compounds. Solubility, *p*H, and cleaning ability are examples of general applicability. A specification for vapor-cleaning compound (steam jenny cleaner), however, must include a water-softening test requirement to ensure nonclogging of vapor generating equipment, soap tank, and dispensing lines. The advantage of the composition-properties type over the straight composition type of cleaning-compound specification is that the desired product is much more completely described, and consequently there is less chance of obtaining unsatisfactory material.

Laboratory-performance Type.—The chief characteristics of this type of specification are: first, it contains no composition requirements; second, it includes short-time laboratory performance tests that have been developed and correlated with full-scale production cleaning; and third, it includes a "standard comparison cleaner" of given composition, which serves as a basis for comparison of the cleaning compounds submitted by suppliers. The "standard comparison cleaner" has been developed by the purchaser as a product capable of giving effective cleaning. It is specified that the purchaser's laboratory compound it and carry it through the prescribed performance tests simultaneously with samples of the purchased material. The specification requires that the compound submitted by the bidder, when subjected to the performance tests, shall remove soil at least equally effectively as the "standard comparison cleaner". It serves as a guide to the supplier, indicating to him the result of the purchaser's research in developing a suitable

product. To an organization versed in the art, it may be the starting point for further experimentation leading to improved and more economical products, which, incidentally, is one of the objectives or advantages of the laboratory-performance type of specification.

Requirments in Laboratory-performance Type Specifications

The performance requirement of an alkaline-cleaning-compound (soak or electrolytic) specification evaluates the chief elements of a cleaning solution, namely, its cleaning effectiveness, its cleaning capacity prior to exhaustion, and its stability. This involves the development of a selective and reproducible cleaning test, one that simulates and can be correlated with the production cleaning cycle. The cleaning test includes the following standardized details: composition, heat treatment, surface finish and precleaning of test panels; type of soil or soils; method of soil application to test panels and soil "aging"; cleaning conditions, such as volume, temperature and agitation of solution; rinsing conditions, such as volume, temperature and agitation of rinse; lengths of time of cleaning, rinsing and draining; time and temperature of drying of cleaned and rinsed test panels; evaluation of the cleaned, rinsed and dried test panels.

Cleaning effectiveness, which is determined at the same time as the cleaning capacity, may be expressed in terms of amount of residual soil after a definite cleaning period or time to effect complete cleaning. Details of these methods have been described and discussed[1].

The test for solution cleaning capacity consists in running a succession of standard soiled test panels through a single batch of cleaning solution under the standard conditions and noting the point at which a decrease in cleaning effectiveness occurs. The test may be carried out either with test panels carrying one type of soil or with a combination of test panels coated with different soils. The cleaning capacity is expressed as the area of surface cleaned, the weight of soil removed, or simply as the number of test panels cleaned at optimum effectiveness. Since the purchased material is examined simultaneously with the "standard comparison cleaner", it is not customary to carry the cleaning-capacity test to the point of actual exhaustion but to determine if the material will clean a smaller, perdetermined number of test panels known to be within the capacity of the "standard comparison cleaner".

Solution stability is an important element in the evaluation of an alkaline cleaner. In order to meet cleaning-effectiveness requirements, modern cleaners must be compounded with synergistic combinations of surface-active agents. While many synthetic detergents and wetting agents are stable in hot alkaline solution, it is essential that the specification ensure against the inclusion of ingredients that hydrolyze or otherwise decompose under such conditions. This is accomplished by including a solution-stability test in the laboratory performance requirement. It consists of a capacity test run on a batch of cleaning solution after it has been boiled for 40 hours. The prolonged high temperature in alkaline medium results in a loss of detergency if unstable surface-active agents were present in the cleaning compound.

The performance requirement of a laboratory-performance type of specification is usually supplemented by chemical- or physical-properties tests or both. For example, corrosiveness and *p*H requirements indicate to the supplier the type of compound desired and aid him in the selection of raw materials. Thus, if the specification prescribes that 2S aluminum shall suffer no loss in weight and Alloy No. XXXIII (A. S. T. M. Spec. B86–43) zinc-base diecast metal shall lose no more than 1.0 milligram per 100 square centimeters of surface under definite conditions of total immersion in the cleaning solution, the supplier knows that his formulation must contain certain ingredients or combination of ingredients (for example, sodium trisilicate of approximately 1:3 soda-silica ratio, either alone or combined with metasilicate).

While the performance requirement of a soak- or electrolytic-cleaning compound is built around a detergency test, this does not mean that all cleaning-compound performance requirements are of a similar nature. The most important characteristic of the cleaner is selected as the factor around which the performance test is developed. Thus, in the case of a vapor-cleaner specification, the most important factor is the water-softening ability of the cleaner. Hence, the performance requirement of such a specification is a selective sequestration test. Since polyphosphate softeners tend to decompose at elevated temperatures in alkaline solution, this test is conducted under simulated field conditions, for example, at temperatures corresponding to steam pressures of 25–50 psi. A laboratory steam sterilizer may be used to provide the high temperature.

The main advantages of the laboratory-performance type of specification are:

(1) Manufacturers are encouraged to develop improved and more economical products, because no restrictions are placed on the use of suitable raw materials.

(2) In cases of emergencies leading to shortages, changes in formulation are quickly made, provided performance requirements are met.

Conclusion

It is obvious that important advantages result from the use of "laboratory-performance" type of cleaning-compound specifications. It is well to remember that this type of specification is made possible by the development of selective short-time laboratory tests, that have been correlated with production cleaning.

REFERENCE CITED

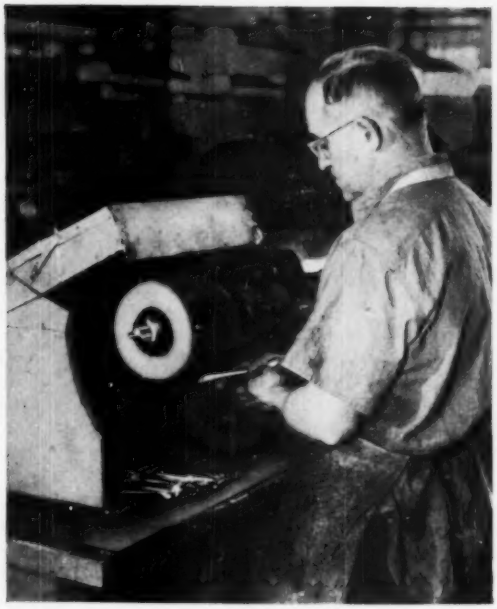
[1]A. Mankowich, Metal Finishing 45, No. 12, 77–78, 88 (1947).

Creating Modern . . . Silverware Part II

LAST MONTH Mr. Frank C. Mesle of the Works Laboratory of Oneida Ltd., Oneida, N. Y., showed how tableware design is transferred to dies and how forks, spoons, and knives are made.

This time he describes the polishing, buffing and plating operations which produce the finished product and how research, development and testing activities play an important role in the production of quality silverware.

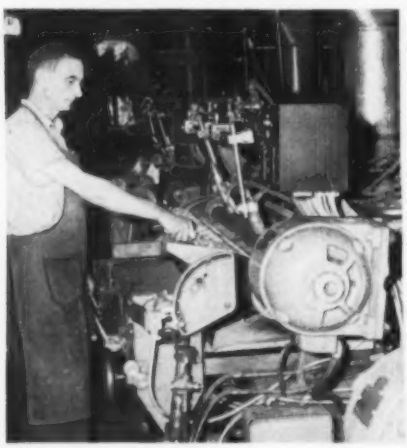
Fork tines are belt polished on edges and pointed.



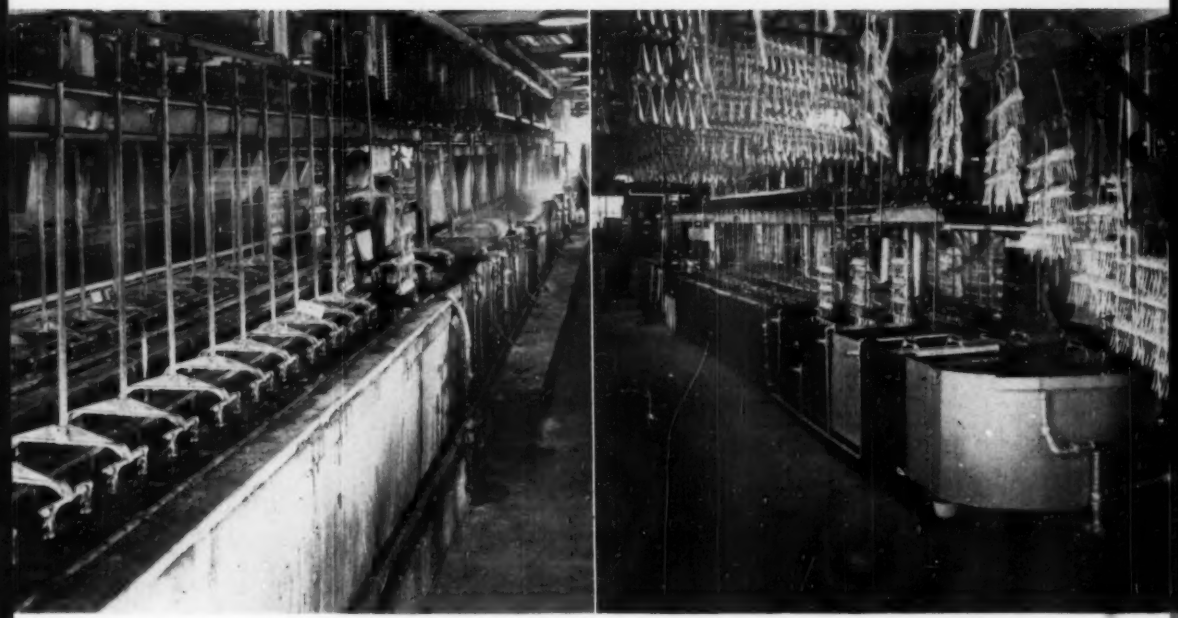
Hand buffing.

In the Half Finish Department on page 845 edges are finished on emery wheels and other surfaces are polished all over. The amount of finishing depends on the quality of the article.

Automatic machine for buffing front and back of fork tines.

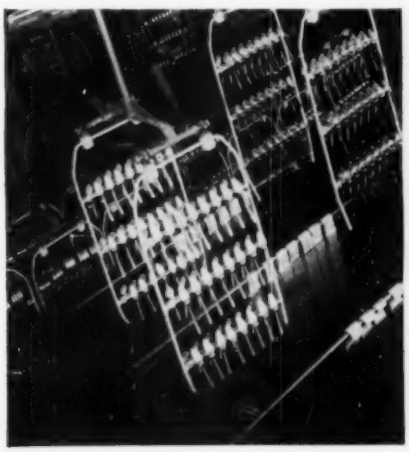


Rotary buffing machine for spoons.

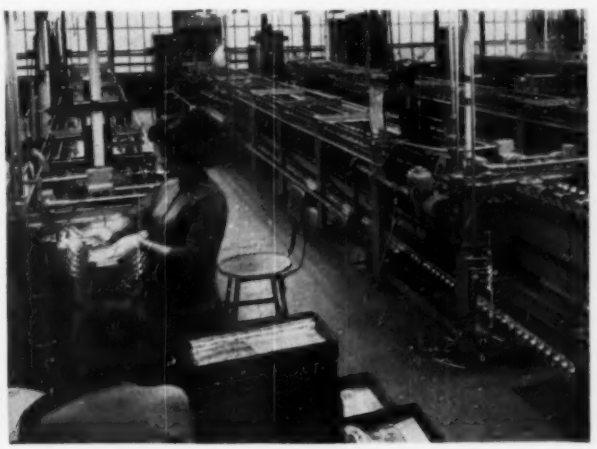


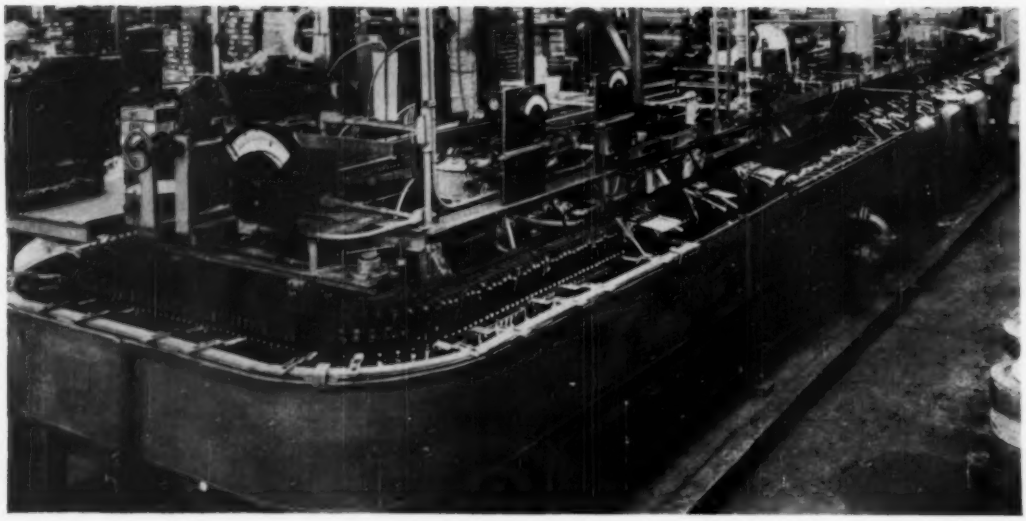
One of several fullautomatic plating machines for nickel and silver plating. Each is in operation two shifts per day. The conveyor at right front carries racks to the loading stations.

Electropolishing tank in fullautomatic machine. The racks to the left are entering, those to the right are leaving the solution. The racks with forks in the lower background are at the unloading station. (Also on cover.)



In these fullautomatic plating machines, designed and built by Oneida engineers, an extra thickness of silver is deposited on the points of highest wear, i. e., on the back of the spoon bowl and on the back of forks above the tines. The standing girl is loading, the sitting girl unloading the conveyor which carries the work to the machines.



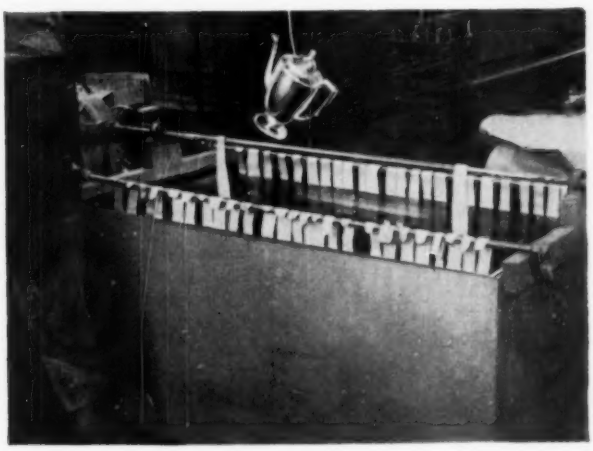


Knife handles are nickel and silver plated in two of these special Oneida machines, which operate two shifts a day. Beginning where the girl stands at the loading and unloading station at extreme right, one can see, clockwise, the cleaners and rinses, the nickel plating, rinsing, silver striking, and silver plating tanks.

The kind of finish desired determines what wheels and abrasives are used in the final operation.

Each finished piece is carefully inspected and wrapped in tissue paper. Note the clean gloves used to avoid stains by finger marking.

Silver plated hollowware is another Oneida product. This picture shows how it is electropolished after plating.

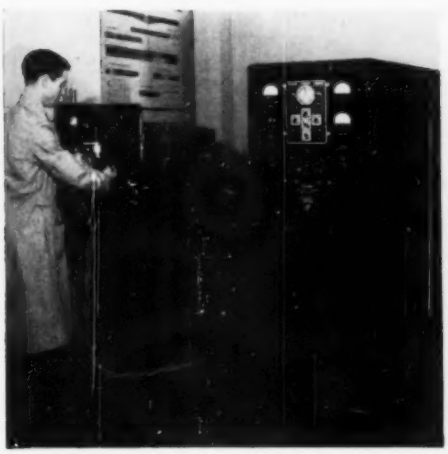


The three pieces to the right show the increase in lustre produced by electropolishing.

A view of the Chemical Laboratory. Much of the improvement in processes and quality is due to the laboratory technicians who develop new and better methods, set up standards and controls, and specify and test supplies.

Spectrochemical analysis is playing an ever-increasing role in control and research. The ARL spectrograph shown here is used to detect, and sometimes to determine the amount of minor but important impurities in metals, alloys, and solutions.

The Experimental Plating Department serves to try out and prove with full-scale racks proposed changes in solutions and cycles before they are made in production.



Strength and Ductility

(*Continued from page 834*)

In one case the tear was along a chord as much as half the radius distant from the diameter—a circumstance which tends to confirm the conclusion that the test material was not as uniform as could be wished. On the other hand, the data from tests in which off-center tears occurred were not out of line with the data for other tests on the same material where the fractures were closer to the diameter. The fractures in the annealed specimens were pinholes which on close inspection at low magnification usually proved to be tiny slits.

The tears in the as-plated specimens were always in the same orientation with respect to the original sheet, namely, parallel to the direction of burnishing of the lead roll on which the sheet was deposited. This evidence of anisotropy[†] has also been noted by Shakespeare[2]. The fractures in the annealed specimens did not exhibit any preferred orientation.

The possible effect of anisotropy in the specimen on the results obtained in the bulge test cannot be ignored. It must be recognized that the tensile strength found in the bulge test is that which prevails in the direction where this property is at a minimum in an anisotropic specimen. This is no disadvantage since it is the minimum value which is of the most practical interest. Of more serious import is the question: does anisotropy invalidate the test results? Since it was assumed in deriving the equations pertaining to the test that the material under test was isotropic, a strictly rigorous answer would be in the affirmative. For practical purposes, however, anisotropy which does not lead to a bulge that is *measurably* asymmetric may be neglected, and since this is the situation which prevails in the present work, no concern need be felt.

It is interesting to speculate on the bulge test as a possible means of measuring anisotropy in an electrodeposit. This could conceivably be done by measuring the asymmetry of an originally symmetrical photo grid on a specimen which had been blown to a point just short of fracture. This might be possible on a ductile specimen where the strains can be made quite large. So far as the as-plated specimens investigated to date are concerned, the strains at fracture are so small that the intrinsic variations in the photo grid, to say nothing of mensural errors, are too large to allow of measurements which would reveal asymmetrical deformation arising from anisotropy. It would be far better to detect the presence of anisotropy by X-ray diffraction investigation and to evaluate its extent by this or other methods.

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[1]T. A. Prater and H. J. Read, Plating **36**, 1221–1226 (1949).
[2]W. M. Shakespeare, Trans. Am. Inst. Mining Met. Engrs. **106**, 441–448 (1933).

[†]Anisotropy simply means different physical properties in different directions. EDITOR.

✤ Edward Leo Gann ✤

Eddie Gann, 58, passed away on Friday, June 30, after nearly half a year's illness.

Gann could be called the original electroplating-solution doctor without degree. He could always put his finger on plating difficulties and bring solutions up to top notch performance. He had been doing that for the Hanson-Van Winkle-Munning Company and its predecessor, the Hanson & Van Winkle Company, since 1915. During the many years that followed, Gann's friendly manner and ability won him a host of friends among several generations of platers.

Gann did not come by his know-how in the usual way. He started with Hanson & Van Winkle back in 1908 as a handy man. From this humble beginning, he advanced through the machine shop, where he assembled and repaired motor-generator sets and manufactured plating barrels, first to foreman of the Anode Department and then, by 1914, into the experimental section of the Hanson & Van Winkle job-plating plant. During this time he attended High School chemistry classes at night and did so well at it that he assisted as a part-time instructor.

It took Gann only a year to rise to top man in the job-plating division. This was the period when electroplating was considered an art and the know-how was closely guarded. Gann developed many successful brighteners and solutions, sharing his knowledge liberally with his friends in the industry. Solution filtration and purification were in Gann's bag of tricks long before they became generally accepted practice. He was also an expert polisher and buffer, with an unusual ability to teach the art.

Maybe the fact that he was born in Brooklyn accounted for Gann's interest and ability in sports. In the early days, he was a top-flight semi-professional baseball, basketball and football player as well as a more than passable professional boxer.

He was a former president of the Newark Unity Club and, for many years, a member of the Newark Branch of American Electroplaters' Society. He leaves behind four daughters and a host of friends who will miss him for years to come.

Current and Metal Distribution in Electrodeposition

I. CRITICAL REVIEW OF THE LITERATURE

project no. 11

project director:

JOHN KRONSBEIN*

location:

EVANSVILLE
COLLEGE,
EVANSVILLE, IND.

Acknowledgment is due the Research Committee, Mr. William Tucker, Eastman Kodak Company, Chairman; the Research Directing Sub-Committee, Mr. B. C. Case, Hanson-Van Winkle-Munning Company, and Mr. G. M. Cole, Ternstedt Division, General Motors Corporation, Chairman and Vice-Chairman, respectively; and the Project Committee, Dr. R. A. Schaefer, Cleveland Graphite Bronze Company, Chairman; Mr. Leonard E. Weeg, National Lock Company, and Dr. Harold Wiesner, Bendix Corporation, for their contributions to this project.

The first question that arises when one is confronted with such problems as those of current and metal distribution in electroplating is whether they can be solved by means of application of known theories without the use of lengthy experimentation. This historical review shows that, while considerable work has been done and fundamentally similar problems exist in many apparently unrelated fields, existing mathematics is not capable of solving any but the most simple problems and those usually only by disregarding polarization at the electrodes. The chief task of this research project, therefore, is to develop experimentally desirable practical information which is directly applicable to commercial electroplating baths. This work is proceeding with studies of fillets and their radii on both inside and outside corners and their effect on metal distribution with respect to the flat surfaces. Results of this work will be published from time to time in this journal as the experimental work unfolds the behavior of conventional plating baths. EDITOR

Electrodeposition is mentioned in the scientific literature shortly after Volta had demonstrated his electric battery around 1800. Electroplating development for commercial and scientific purposes began to expand in the early 1830's, largely due to the work of Faraday, who had enunciated the basic laws of electrolysis in 1833, and the invention of an improved Volta battery in 1836 by Daniell.

The first scientific paper on the subject of current distribution appeared in an Italian journal written by Nobili[2], who apparently reported qualitative results only. At that time Ohm's law was not yet widely known, although Ohm's book[1], giving the first mathematical treatment, had been published at Berlin in 1827.

Nobili in his experiment poured a solution of lead oxide in concentrated potassium hydroxide on a horizontal sheet of platinum or gold. He made this sheet the anode of a cell and used as the cathode a small platinum wire in contact with and perpendicular to the surface of the solution. These electrodes were connected to batteries, which consisted of from three to sixteen Grove primary elements[35], so that a potential difference of from 5 to about 30 volts was applied through the cell. Electrolysis of the solution resulted in the deposition, or plating, of lead peroxide as a thin layer on the sheet anode, which soon exhibited Newton interference rings of different colors on the surface. The thickness of these deposited rings varies with the distance from the wire point cathode to the sheet anode their thickness and can be puted from known wave lengths of visible light. On the other hand, Faraday's Law states that the thickness is proportional to the current density at any point. Therefore these theoretical approaches offer a basis of determing metal distribution. Nobili did not progress this far but confined himself to a description of the interference fringes or rings, which were thereafter called Nobili's Color Fringes.

Eleven years after Nobili's publication Edmond Becquerel[3], an ancestor of the famous Henri Becquerel who discovered radioactivity, made an attempt to evaluate Nobili's experiments quantitatively. He made the assumption that the current is conducted through the solution along straight lines and deduced from

*AUTHOR

experimental evidence that the current density was inversely proportional to the distance between the point of the anode under consideration. This formula was later found to be in error. E. du Bois-Reymond, an eminent physiologist, physicist and mathematician, and his disciple W. Beetz[4] re-examined the problem in 1847. They likewise assumed that the lines of constant current density are straight, but noticed that the current entered the anode at right angles to equipotential lines, of which the anode is one. Their reasoning led to the conclusion that the thickness of the deposit at a given point on the anode is inversely proportional to the *cube* of the distance from the point cathode. Polarization is mentioned for the first time by these authors, but they deliberately leave it out of consideration to simplify the discussion.

It seems that du Bois-Reymond assigned the experimental work of verifying his revised theory to W. Beetz[4], who repeated Nobili's experiments in general but showed that lead acetate could be substituted for the lead oxide mentioned earlier. In his work he produced as many as eight sets of color rings, and he pointed out clearly that the brown deposit near the cathode was lead peroxide in sufficient thickness to disclose its natural chocolate-brown color. Beetz measured the ring diameters with great care and tried to make his results agree with those of Becquerel, but he failed to obtain good agreement with either the latter's or with du Bois-Reymond's theory. In one of the final sentences of his publication he despairingly confessed himself as being incapable of solving the problem of explaining the wide divergence between his own and Becquerel's experimental results or suggesting conditions to which Becquerel's experiments had been subjected that might have been different from his own.

The next study of current distribution was attempted nearly 20 years after Nobili's publication, by Bernhard Riemann[5], a pure mathematician (the same, after whom Riemann Spaces and other mathematical concepts and relations are named). He wrote a purely mathematical exposition of the problem on the basis of potential theory of the experimental set-up described by his predecessors. The mathematical formulae are exceedingly complex, but Riemann was able to draw some conclusions as to the validity of du Bois-Reymond's and Becquerel's deductions. He clarified the problem from a point of view of mathematical formulation and found that the thickness of an anodic deposit of lead peroxide was theoretically neither inversely proportional to the distance between the cathode and the anode point considered nor to the cube of that distance. Above all, by giving an explicit expression for lines of constant current density (along which the current flows), he showed that the current cannot flow in straight lines. Except for the limiting case when the layer of solution on the top of the anode is infinitely thick, du Bois-Reymond's inverse cube law was shown to be incorrect.

Beetz[6] studied this subject in a later paper, but no new significant results were revealed.

Some reference to current distribution is made in the famous book, "Theory of Electricity and Magnetism", published in 1873 by J. C. Maxwell[7], but the results are not sufficiently extensive to make them applicable to electroplating.

The next significant study of current distribution was by another mathematician, Heinrich Weber[8], who indicated applications of Bessel Functions to the theory of electric current. This is the first paper in which polarization and current distribution together are given some mathematical consideration. Weber enunciated the "second boundary-value problem" of potential theory, which incorporates (linear) polarization, as contrasted with the "first boundary-value problem" of potential theory, in which polarization plays no part. It should be stressed that the "second boundary-value problem" involves only the first approximation to the problem of polarization in electrodeposition. Weber stated the problem fully; later (see for example Byerly[10], where references are given) other mathematicians gave mathematical proofs for the existence of certain solutions to this problem. However, no practical results suitable for use in the field of electrodeposition have been discovered to date. Exception should be made in the case of one of the papers by Kasper[46], which will be described more fully later. In the case of an infinite-plane cathode with an infinitely thin wire anode at a given distance from the former, Kasper gives the solution to the (linear) polarization problem, but this is probably the only case that can be handled explicitly by means of existing mathematical theories and is so simple as to reveal little significant information on the practical current-distribution problem. Certainly its solution did not yield any clues as to how complex cases should be treated.

In 1890, P. Joubin[9] published a short paper in which he, without proof, set up an algebraic expression purporting to represent current distribution on a horizontal flat square cathode plated with copper. The anode was a point electrode simulated by means of a fine platinum wire as in Nobili's original arrangement. He verified the algebraic formula experimentally by dividing the square cathode into smaller squares, dissolving off the deposit, and determining the thickness of deposit by analysis. Very close agreement between formula and the experiment was found, but owing to the brevity of the paper, no method of deriving the formula was given.

A widely used text by Foerster[11], published near the turn of the century, introduced the idea of "cathode potential" to explain the changing current densities from point to point on a cathode. However, it failed to distinguish between "primary" and "secondary" current distribution. The term "cathode potential" implies polarization effects; these change the primary distribution into secondary but are not responsible for the circumstance that the primary distribution is in general not uniform. This text attempted to bridge the gap between the mathematician and the electrochemist, but unfortunately the terms and problems increased rather than decreased the confusion surrounding practical current and metal distribution.

Generally speaking, prior to World War I, current and metal distribution problems were investigated theoretically only by mathematicians. In practice electroplating was considered an art, and its problems were solved largely by the ingenuity and experience of the individual electroplater and were well guarded shop secrets.

The expansion of plating into mass production created a strong impetus to discover new processes and operate older ones on a large scale. This economic urge demanded more knowledge of the practical operation of the various plating processes, including metal distribution. Perhaps the period from 1910 to 1940 can best be characterized by the development and application of empirical quasi-scientific, qualitative tests to control and operate automatic processes for mass produced articles. The result is, as expected, a fairly large literature on current and metal distribution from a practical electrochemist's point of view. There was very little forethought given to a purely mathematical method involving cell geometry. A new concept called "throwing power", a "property of a solution", was introduced in the hope of arriving at simple quantitative laws governing current distribution.

A number of publications[16-21,33,36,38-40,43,47,56] belong to this period.

Only three investigators seem to have maintained a certain degree of clarity about the necessity to distinguish between "primary" and "secondary" current distribution[17,22], but they did not have available for their support the "normal derivative" of a potential function, which had been introduced previously by mathematicians[5,8] and was subsequently to be reintroduced by Kasper. By its means they could have evaluated primary current distribution directly. It was realized by them[17] that "primary distribution is determined solely by the dimensions of the electrodes and electrolyte", but the geometry of the complete cell was not taken into consideration, and thus no real progress resulted. The extent of the vagueness of ideas on the subject is indicated in a paper by Pan[22]. In this article a practical scale for evaluating covering power of a plating solution was

introduced. This was of obvious value to the practical electroplater. The author stresses that "to the practical plater throwing power means primarily the power of a plating bath to throw or deposit metal into recessed parts and at the same time not to burn the projecting parts of the cathode".

The simplified theories of this period employed only "longest and shortest direct paths" between anodes and cathodes for evaluating current density relationships. Some of these simplifications created a measure of confusion[18,25,26].

A paper by A. Portevin and M. Cymboliste[32] is along the same general lines as those by Blum and his collaborators. They stress the inadequacy of conventional throwing-power measurements and the bent-cathode tests. However, they overlooked the importance of edge effects caused by stopping off the electrodes.

The investigations by Mantzell[20,29] and Busse[24] did not correct the theoretical approach to these problems in the slightest and prove useless from a point of view of elucidating current distribution. It seems that these authors tried to evaluate current distribution but confused it with "covering power". A valuable part of Mantzell's work is the method of practical determination of metal distribution by subdivision of the cathode into thin strips mounted on an insulator of the cathode shape to be investigated. Each strip is connected to the supply of constant potential through a separate ammeter, thus indicating directly the distribution of current to different parts of the cathode. On the other hand, an error made in this work is the failure to eliminate "edge effects" [see reference[66]] of the narrow strips, so that the numerical results are of doubtful value. Apparently Onitschenko[30] obtained his idea for a demountable bent cathode from this paper. Mantzell also studied the effect of insulating shields with slots and holes, placed between anode and cathode. He concluded that a narrow slot in a large insulator between the electrodes behaves as though the slot became the anode.

Papers by Meyer[42], Gardam[43], and Kangro and Wagner[38] make a number of comments on current and metal distribution but do not contain any significant mathematics to advance our knowledge. Kangro and Wagner describe a simple current-density meter of value.

Ingenious "throwing power boxes" were designed by various investigators during this period to evaluate current distribution for the practical electroplater[17,18,21]. In skilled hands these have unquestioned value, as for instance Pan's cavity scale[23], the bent-cathode tests[19,21], Onitschenko's demountable bent cathode[30],and the Hull cell[16]. However, the transfer of these results to actual plating conditions and deposits are doubtful, in any case empirical, and largely unsolved in mathematical theory.

Busse's work[24] involves the use of a cell in many ways similar to that of Hull[16]. The ingenious use of an exploring electrode for locating equipotentials is noteworthy.

By far the most important recent contribution on the subject of current distribution in electrodeposition was made by Charles Kasper[46] in a series of papers published both in THE MONTHLY REVIEW of the American Electroplaters' Society and in the Transactions of the Electrochemical Society during the period from 1939 to 1941. Kasper reverted to the correct mathematical enunciations of Riemann and Weber. According to them, the problem *without polarization* involves the determination of a potential function that has one constant value on the cathode and another, more positive, constant value on the anode. This is the mathematical "first boundary-value problem" in its simplest form. The potential function has certain mathematical properties into which we need not delve, but its normal derivative along the cathode and anode, i. e., the potential gradient along these electrodes, yields the mathematical expression for current distribution. One method of presenting this data is to plot it directly on the electrodes. The problem *with polarization* is much more difficult and involves the determination of a potential function that has a value along the cathode and anode that is not constant but proportional to the current density; therefore it involves not only a potential function but its derivative as well.

It should be mentioned that the boundary-value problems had been dealt with in great detail by mathematicians and physicists for over a hundred years prior to Kasper's time, but no direct application specifically to electrodeposition had been made other than in the two publications by Riemann[6] and Weber[8]. Kasper's contribution consists in a direct application of potential theory to electrodeposition, with concrete evaluation for an expression of current density and graphs for simple electrode arrangements, such as line anode and plane cathode, cylindrical anode and cathode, and the like. Much effort went into these publications. They served to clarify for the electroplater and the electrochemist the actual variables involved. They also pointed out the mathematical significance of polarization which had remained hidden in various mathematical publications more or less inaccessible to the electrochemist. Many readers of Kasper's papers, however, claimed that they were too mathematical to enable the electroplater to put them to use easily and that too many formulae were incorporated which had no interest to them as such.

An attempt to correct this was made by J. Kronsbein[49], who outlined without any mathematics the results of a purely mathematical investigation on current distribution; the mathematical results were given in another, purely mathematical paper by the same author[50].

In a later publication[51], new mathematical results are enunciated for electrochemical application. The mathematical formulae are complicated, but the results of plotting graphs of current densities enable the electrochemist to gain a qualitative insight into the effects of insulation, stopping off of electrodes, shielding by metal, insulating shields, etc. Polarization is left out of these cases. The mathematicians realize that explicit results incorporating polarization are not easy to obtain with mathematical methods known at the present time.

The first practical application of Kasper's work was by Schaefer and Mohler[53], who measured ratios of maximum to minimum deposit on the inside of eccentric cylinders and compared the results with those of the theory. It was realized that polarization effects are the cause of deviation from the theory developed by Kasper and that these deviations vary widely with the different electrolytes.

Although the potential theory of current distribution as developed by Kasper represents a landmark in the theoretical understanding of current and metal distribution, it is by no means universally accepted, understood, or appreciated even today. The recent publications by Engel[47], Field and Weill[37], and Tope[58] reject the theory either in whole or in part.

A somewhat different but related subject was investigated by Weisselberg and staff[52], who arranged a configuration which permits taking into account nonuniformity introduced by the resistance of the electrodes themselves. For instance, the voltage drop produced by a thin anode in the center of a long cylindrical cathode, such as a gun barrel, was determined. The data refer to differences in thickness of deposit in the direction of the axis of the cylinder.

The remaining literature contains many references to electrodeposition or electrochemistry but is of little or no practical value, unless the results are altered so as to make them applicable to electrolytic cells. These articles can be divided into two classes: (1) The purely mathematical literature dealing with potential functions and related subjects, such as theory of functions of one complex variable. This field is so vast that a complete list of references would fill several volumes. Even a listing of textbooks would involve considerable printing space. (2) The application of potential theory to some branch of physics, engineering, cosmology or the like. Here again, a complete list would be of considerable size. Good examples are Moulton[12], Knight[22] and Adams[35]. For example, Moulton gives explicit expressions for potential functions relating to square or rectangular enclosures, simulating rectangular tanks,

the derivatives of which may be evaluated for the purpose of studying current distribution on electrodes in special positions in rectangular tanks, etc. Knight developed a method of successive approximations that may lead to results in cases not at present amenable to complete mathematical treatment, but it will be difficult to extract convenient expressions from his paper for preparation of graphs on current densities.

A close analogy to electrodeposition problems of current distribution exists in both practice and theory problems related to vacuum tubes and to photomultiplier tubes on radios and related apparatus. Also in this class belong such remote-sounding subjects as problems of distortion of shafts of engines; these shafts distort under load, giving a stress distribution that is closely analogous to current distribution in an electrolytic cell. More obvious are problems on heat flow through furnace walls, as exemplified in an excellent paper by Langmuir, Adams and Meikle[18], which permits translation into electrochemical language without excessive trouble. Finally there are the many papers by E. F. Adams[19] which are related to this same general subject.

Those readers who would like to delve more deeply into the mathematical phase of the subject are referred to the monumental work by J. H. Jeans, "The Mathematical Theory of Electricity and Magnetism", 5th Edition, Cambridge University Press, 1933. It is a volume of about 650 pages, and will serve as an excellent introduction to this subject.

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QUESTION BOX

readers' questions of general interest

Q. 89. What is the proper sequence for plating lead-alloy castings in acid-copper solution? Can a high-speed cyanide copper bath be used instead of the acid copper?

A. A satisfactory procedure is (1) alkali-spray in a washing machine, or equivalent; (2) hot-alkali soak for a length of time limited by its tendency to etch and oxidize the lead alloy; warm rinse; dip in 10 per cent by volume fluoboric acid; cold rinse; cyanide-copper strike; cold rinse; weak-acid dip; cold rinse; plate.

One may go directly from a relatively heavy copper strike into a high-speed copper cyanide bath.—A. K. GRAHAM.

Q. 90. We are plating a brass (Naval Brass, Grade A, nonleaded) part with 0.00008 inch of 24K gold in the following cycle: degrease, soak clean, rinse, bright dip (sulfuric-nitric), rinse, copper flash, rinse, gold plate, dragout rinse, rinse, alcohol dip, and warm air dry. We have plated a great number of these parts satisfactorily both recently and during the war. Lately it has been proposed that we make this part from a free-cutting leaded brass (B 1644). We have satisfactorily plated sample parts of this material, but our engineers question whether or not, over a period of 8–10 years, we might get into a corrosion problem because of the lead. That is the question for which we are seeking an answer, based on test data or experience.

A. Thin gold coatings applied to leaded brass which has been given the usual sulfuric-nitric bright dip can be expected to be considerably more porous than such coatings applied to Grade A nonleaded brass. The reason for this is that relatively insoluble lead sulfate

(Continued on page 858)

Determination of Cyanide

(Continued from page 848)

barium nitrate solution (about 65 g/l $Ba(NO_3)_2$) sufficient to precipitate about 105 g/l (14.1/gal) sodium carbonate; let most of the precipitate settle and pour the supernatant solution through a No. 42 Whatman filter paper. With a measuring burette, transfer a 50-ml sample of the filtrate into a 250-ml Erlenmeyer flask and add 0.5-ml of 0.5-*M* potassium ferrocyanide (211 g/l $K_4Fe(CN)_6.3H_2O$) equivalent to about 1.5 g/l iron, and 10 ml of 1.5-*M* potassium iodide (250 g/l KI). Using vigorous shaking, titrate against a black background with 0.1-*N* silver nitrate to first white turbidity. Warm to exactly 30° C and continue the titration until the white turbidity reappears. This is the endpoint. The free sodium cyanide content is calculated as follows: g/l free NaCN = 0.98 × ml 0.1-*N* $AgNO_3$; oz/gal free NaCN = 0.131 × ml 0.1-*N* $AgNO_3$. This titration method gives a value for free sodium cyanide which has no direct relation to any theoretical value.

7. The indirect-titration method eliminates the cyanide zinc complex as a factor by the addition of excess sodium hydroxide. The free sodium cyanide plus the sodium cyanide expelled from the zinc cyanide complex is then titrated with standard silver nitrate solution in the presence of potassium iodide indicator. It is necessary, however, to know the formula of the cyanide zinc complex.

8. The present study indicates that the zinc in low-*p*H brass baths is actually present both as $Na_2Zn(CN)_4$ and sodium zincate*. However, for purpose of convenient calculation, the zinc may be considered to exist entirely as $NaZn(CN)_3$. On this basis, the value for free cyanide in a given brass bath obtained by the indirect-titration method has been shown experimentally to be higher than that obtained by the preferred direct-titration.

9. The recommended indirect-titration method for the determination of free cyanide in low-*p*H brass baths in which iron may be present is as follows: Five ml of the brass bath are transferred to a 150-ml Erlenmeyer flask and 10 ml of 20 per cent sodium hydroxide solution, 10 ml of 10 per cent potassium iodide solution, and 20 ml of water are added. The solution is then titrated with 0.1-*N* silver nitrate solution to the appearance of a bluish opalescence. The temperature at the end of the titration is 30° C. The free sodium cyanide is calculated as follows: g/l free NaCN = 1.96 × ml 0.1-*N* $AgNO_3$ − 2.24 × g/l Zn; oz/gal free NaCN = 0.262 × ml 0.1-*N* $AgNO_3$ − 2.24 × oz/gal Zn.

10. This recommended indirect-titration method does not give the absolute value for the free cyanide in a brass bath; such a procedure has not yet been developed. It does, however, give values which are reproducible.

11. For practical purposes a choice has to be made between (1) the preferred direct-titration method with its relatively poor endpoint and high rapidity (2), the indirect-titration method with its sharp endpoint but need for a lengthy analysis of zinc, and (3) the calculation method which requires a lengthy analysis, not only of zinc and copper, but also of total sodium cyanide by the distillation method. The writer believes that the preferred direct-titration method outlined here is the best choice for shop-control purposes, and that the indirect method would be preferred for control in research.

*Ammonia present in the brass bath will probably form a small amount of zinc ammine.

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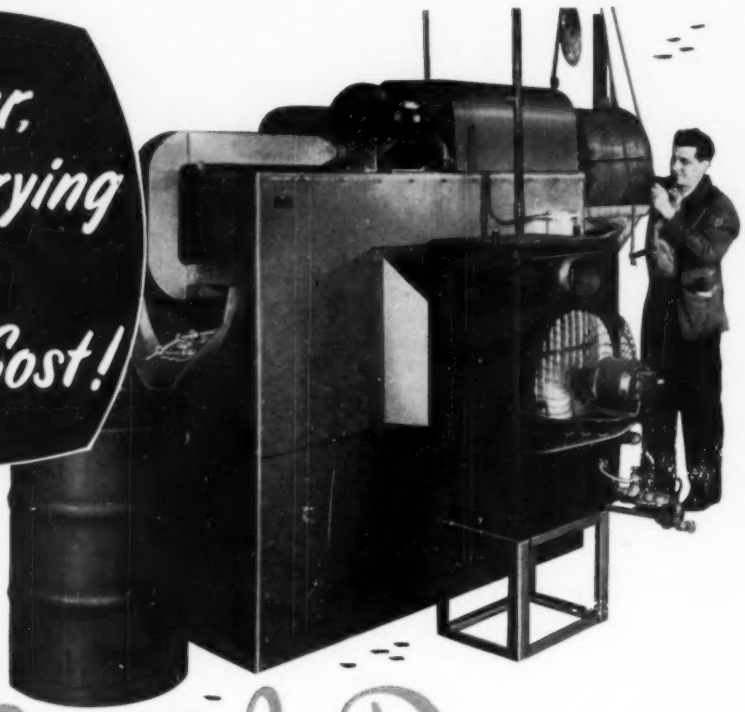

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Book Review

DR. HAROLD J. READ

Associate Professor of Metallurgy, Pennsylvania State College

METAL CLEANING BIBLIOGRAPHICAL ABSTRACTS by Jay C. Harris, 68 pages, 1949. Special Technical Publication No. 90, American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa. Price, $2.75 ($2.00 to A. S. T. M. Members).

The making of a literature survey is invariably a tedious, time-consuming activity, and the publication of annotated bibliographies on specialized subjects is always helpful in easing the labors of investigators in those fields. The metal finisher will find the pamphlet by Harris of great assistance in surveying the literature relative to cleaning.

The 494 references which have been abstracted are arranged chronologically and cover the period from 1893 to 1949. By far the greater number of entries is for the last two decades; in fact, the period 1893 through 1929 accounts for only 24 abstracts. It is evident, therefore, that those interested in the strictly historical aspects of cleaning will not find this bibliography adequate for their purpose. For most research and development and for all practical work, the literature of the last two decades contains everything of interest and significance. It seems, however, that the author has confined his selections to articles that deal primarily with cleaning and has not included papers wherein cleaning operations may be discussed as a supplementary subject.

The length of the individual abstracts varies rather widely. A few are as much as 400 words long, and some contain but a half-dozen words. For the most part, the length of the abstracts appears to be in fairly direct proportion to the probable interest and importance of the article concerned. There is somewhat greater emphasis on the cleaning of aluminum than the other metals, but this is understandable because the bibliography was intended at first to cover only the cleaning of aluminum and its alloys.

The quality of the abstracts is generally quite good. They are terse but usually indicate the scope of the papers to which they refer and the main topics covered therein.

The four indexes, covering subjects, authors, specifications, and patents, are very complete and greatly facilitate the use of the booklet. The abstracts are numbered consecutively and are cited in the indexes according to these numbers; hence, one does not have to hunt through an entire page of fine type to locate the desired item.

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Question Box

(*Continued from page 855*)

is formed on the surface of the leaded brass at the numerous points where lead is exposed to the action of the bright dip. The formation of the lead sulfate and the resulting excessive porosity of the gold coating can be prevented by eliminating the sulfuric acid from the acid dip. The gold plate in the writer's experience was applied directly to the brass without a copper flash, and the effect of the latter in possibly minimizing the deleterious effect of the lead sulfate is not known, but it is suspected that it would be of little benefit. Whether or not you might encounter corrosion problems because of the greater porosity of gold coatings on bright-dipped leaded brass would depend upon the environmental conditions to which the plated parts are exposed.—C. H. SAMPLE.

A. We find no test data, but from very limited experience I would not expect any abnormal effects under normal conditions. However, exposure to salt-water corrosion or to temperatures above 100° C (212° F) would lead to failure of the item. It might be possible to find information about silver plated leaded-brass items subjected to the same corrosive conditions as these parts. With the exception of a lower potential of the corrosion cell, the behavior of the two items should be similar.—E. A. PARKER.

Q. 91 In one tank my silver plate comes out rough on the top side. In another there were black spots all over the silverware, which disappeared on scrapping the over-annealed silver anodes and filtration to the solution. What are the causes of these difficulties?

A. The roughness is caused by material in the solution settling on the work. This material may be insoluble silver salt which has precipitated when acid fumes from acid dips or secondary batteries have entered the plating solution and neutralized it.

Upon melting or overheating, silver will absorb large quantities of oxygen. When an anode containing silver oxide is used in the solution, the silver oxide will form a dark peroxide, which is very slowly soluble. This peroxide will be carried over to the work and cause black spots.—GEORGE B. HOGABOOM.

Q. 92 The nickel plate on our record stamps is inclined to curl, particularly in the center. This trouble can be corrected temporarily by a change in pH. What is the cause?

A. The difficulty is apparently caused by internal stress in the nickel deposit. In deposits from the sulfate-chloride bath, stress is usually reduced by reducing the chloride content and the *p*H. Hydrogen peroxide, carbon dioxide from nickel carbonate treatment, wetting agents, and iron, zinc, lead and sodium salts can all act as stress raisers under some conditions. Ammonium salts reduce stress at high *p*H.

The nickel fluoborate bath gives deposits of lower tensile stress than the Watts bath.—A. K GRAHAM.

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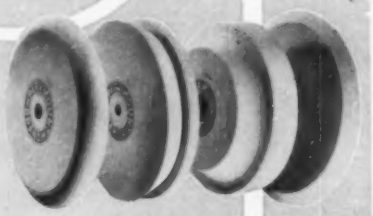

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Article Abstracts

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Gold Plating by the Exudor Process. Metalloberflache **1**, sec. B, B59–B60 (July, 1949).

In the above process, an organic diaphragm is inserted in the bath. The resulting gold deposits are said to be extremely dense and lustrous.

Copper Plating from Straight Cyanide Electrolytes. E. E. Halls. Sheet Metal Ind. **26**, 1505–1508 (July, 1949).

Surveys bath compositions used for copper plating and gives results of experiments with straight cyanide electrolytes varying primarily with respect to free-cyanide content. Working temperatures up to 122° F and current densities up to 20 asf were covered. Results are tabulated and charted.

The Use of Lead-Bronze Bearings in Engine Construction. B. Garre. Arch. Metallkunde **2**, 143–145 (April, 1949).

Discusses the frictional properties of above bearings as compared with babbit bearings. The behavior of babbit metal, silver, lead-bronze, and copper is indicated. Because of its hydrogen content, electrolytic

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copper is found to have good frictional properties. Data are graphed.

Punch Card for the Field of Metal Finishing. T. A. Hood. Metal Progress **56,** 75–78 (July, 1949).

Describes and illustrates the above, designed at the Defence Research Laboratories of the Commonwealth of Australia's Department of Supply and Development. It is the first of a coordinated series of cards planned to cover each of several divisions of metallurgy.

The Structures of Alloy Electrodeposits. VI. The Cadmium-Zinc Alloys. Ernst Raub and Bernhard Wullhorst. Metallkunde **40,** 266–270 (July, 1949).

Discusses the deposition of cadmium-zinc alloys from cyanide and acid electrolytes; the relation between cathode potential, composition, and structure of the deposits; and the results of X-ray and microscopic investigation, as well as hardness measurements. Presents charted data and photomicrographs.

Subsequent Treatment of Phosphate Coatings with Chromates. W. Machu. Arch. Metallkunde **3,** 250–253 (July, 1949).

The porosity of phosphate films is reduced by treatment with sodium chromate, potassium dichromate, or chromic acid. Chromate-treated phosphate coatings have an increased electrical resistance not only because of their reduced porosity but also because of the passivating effect of the chromate in the pores of the protective film. Includes graphed and tabulated data.

Theory of Phosphating. A. Wustefeld. Arch. Metallkunde **3,** 253–255 (July, 1949).

Shows that the theoretical principles of phosphating in acid and in alkaline baths are the same. In both cases, the removal of hydrogen or hydroxyl ions in excess results in formation of colloids with charges opposite that of the attacked metal and hence in strong adhesion of the film to the metal. A method for phosphating aluminum is presented.

Surface Treatment of Malleable Cast Iron. Pierre Tyvaert. Fonderie 1626–1627 (June, 1949).

Describes a new method of chemical tin coating of malleable iron, developed on a laboratory scale. Possibility of application on an industrial scale is indicated.

Production of Hot- and Cold-Rolled Strip and Sheets. Part VII and VIII. Charles L. McGranahan. Steel **125,** 91 (July 18, 1949); 80 (July 25, 1949).

Part VII deals with hot-dip and electrolytic galvanizing and surface-preparation procedures and equipment. Satisfactory coating thicknesses for various uses are indicated. The final part discusses electrolytic galvanizing lines, formed-steel products including corrugated roofing and siding, and methods of hot rolling and finishing of stainless and heat-resistant steel sheets and strip. Illustrated.

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Patent Abstracts

GEORGE B. HOGABOOM

Consultant, New Britain, Conn.

Copies of patents may be obtained by writing to Commissioner of Patents, Washington 25, D.C. Price 25 cents each.

No. 2,504,238, April 18, 1950—Anode Assembly—Andrew Wesley, assignor to The International Nickel Company, Inc.

Heretofore, one of the factors preventing the more extensive use of nickel and nickel alloys in electroplating articles and assemblies thereof, used at the anodic terminal, especially in a sulfate-containing nickel plating bath, has been a preferential corrosion due to the contact of dissimilar metal compositions subject to the electrolytic effects of the plating bath in plating therefrom, one of said metal compositions being that of the nickel anode material. Thus, for instance, difficulty has been encountered with nickel weld material used in welding together lengths or parts of nickel, particularly electrolytic nickel, to produce anodes or parts thereof that exceed in length the available nickel anode stock. Similarly, difficulty has been encountered with nickel weld metals used in welding together pieces of nickel to produce anodes having some particular or desired configuration, as it has been found that when nickel is used to weld together pieces of nickel to form anodes or parts thereof, the nickel weld metal is subject to preferential corrosion, often resulting in severance of the anode along the weld joint.

CLAIM 1. A new article of manufacture comprising a plurality of nickel members, a supporting member, and a plurality of weld metal joints joining said nickel members and said supporting member into the structural form of an electroplating anode suspended in use by said supporting member, said member having controlled metal compositions containing 8 to 30 per cent chromium, at least 8 per cent nickel, and 0.1 to 74 per cent iron, the sum of the chromium, nickel and iron contents being at least 90 per cent, said anode being characterized by improved resistance to preferential attack at the welds and supporting member when subjected to anodic attack during electroplating from a sulfate-containing nickel electroplating bath.

4 claims, 10 figures, 6 examples.

References cited: U. S. Patents 1,185,959; 1,433,618; 1,596,030; 1,734,909; 2,285,554; 2,422,489; 2,467,852. British Patent 520,211. "Corrosion Resistance of Metals and Alloys", by McKay and Worthington (1936), pp. 32, 33 and 358.

No. 2,504,239, April 18, 1950—Nickel Plating—E. J. Roehl, assignor to The International Nickel Company, Inc.

CLAIM 1. The method of electrodepositing nickel with a welded electrolytic nickel anode which comprises establishing in aqueous nickel electroplating

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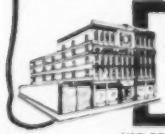

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Patent Abstracts

baths having a *p*H up to about 4.0 a chloride normality of about 0.4 to about 2.8, and a nickel sulfate content corresponding to 300 to 29 grams per liter of $NiSO_4.7H_2O$, and said *p*H and chloride normality being correlated to fall under curve A in accompanying Fig. 3; immersing in said nickel electroplating bath a welded electrolytic nickel anode comprised of a plurality of portions of electrolytic nickel welded together with at least one nickel weld-metal joint, said welded anode being so immersed in said bath that said nickel weld joint is exposed in contact with said electrolytic nickel to said nickel electroplating bath, said nickel weld metal containing about 0.1 to 2 per cent silicon, about 0.03 to 2 per cent titanium, up to about 2 per cent aluminum, up to about 2 per cent manganese, about 0.04 to 0.12 per cent magnesium, with the balance essentially nickel constituting at least 97 per cent of the weld metal, said electrolytic nickel being the type produced from a sulfate-chloride electrolyte and containing about 0.001 per cent lead, about 0.001 per cent arsenic, about 0.001 per cent iron, about 0.003 to about 0.005 per cent copper, about 0.01 to about 0.1 per cent cobalt, with the balance essentially nickel; and passing a plating current from said welded anode to a cathode immersed in said electroplating bath to corrode anodically said welded anode without producing preferential corrosion of said nickel weld metal with respect to said electrolytic nickel of said welded electrolytic nickel anode.

2 claims, 4 figures, 3 examples.

References cited: U. S. Patents 1,185,959; 1,433,618; 1,504,206; 1,562,711; 1,584,959; 2,358,995; 2,394,874; 2,467,852. British Patent 520,211.

No. 2,505,531, April 25, 1950—Magnetic Jig for Electroplating—W. B. Ellwood, assignor to Bell Telephone Laboratories, Inc.

CLAIM 1. A jig for positioning magnetic material wires in an electroplating bath consisting of a solenoid encompassing a plurality of magnetic cores coordinately arranged, each having an end face in the same plane and each being electrically insulated from the others, a guide for guiding each separate wire to be electroplated consisting of a slab of insulating material mounted in a plane parallel to said plane of said core end faces and having a hole only slightly larger than and conforming in shape to the wire to be guided thereby for each of said magnetic cores constructed along the axis of each said core, a separate resistance element connected to the other end of each said core, said resistance elements having their other terminals multiplied to a common wire whereby a plurality of wires to be electroplated may be magnetically suspended through energization of said solenoid while each is connected in an individual electrical circuit by electrical connection to the face of the said core to which it is attracted and restrained from lat-

eral movement away from its own axis and the axis of said core from which it is suspended.

2 claims, 4 figures.

References cited: U. S. Patents 1,168,280; 2,438,897. British Patent 353,332.

No. 2,505,776, May 2, 1950—Method of Manufacture of Hollow Floats of Thin Metal for Ship Compasses—J. M. S. Kaufman, S. Krasnon and J. A. Schaerfl, assignors to Shelley Krasnon, Washington, D. C.

CLAIM. A method of manufacture of hollow floats of thin metal for ship compasses in which a plating procedure involving immersion of said float into a hot plating bath is involved, which comprises the steps of forming a float, attaching a breather tube to an opening in said float, then immersing the said float in a plating bath, with the opening of the breather tube exposed to the atmosphere, plating said float while in said plating bath, removing said float from the bath, removing said breather tube, and sealing said opening in the float, the breather tube preventing the setting up of undue strain in the float due to expansion of air therein.

1 claim, 9 figures.

NOTE: One of the parts of the float is made of Alnico, and it was found that this could be successfully plated in an alkaline tin bath.

References cited: U. S. Patents 883,756; 950,777; 1,560,017; 1,827,142; 1,904,432; 1,906,376; 1,975,818; 2,057,762; 2,333,567. Metal Ind. 371, 372 (October 18, 1929); 161–164 (April 1, 1939). "Electro-Tinning", by S. Baier, Intern. Tin Research and Developm. Council No. 2 (1939) pp. 3–4. Electrodepositors' Tech. Soc. 12, 65–68 (1936–1937). Tech. Pub. Intern. Tin Research and Developm. Council Series A, No. 67 (1937), pp. 3–8.

No. 2,506,794, May 9, 1950—Apparatus for Electroplating—J. W. Kennedy, A. P. Knight and H. J. Lee, assignors to Revere Copper and Brass, Inc.

CLAIM 4. In an apparatus for electrodepositing on the bottom and side wall portions of the outer surface of revolution of a metal cooking vessel a metallic coat-

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ing which on said wall portions is of gradually decreasing thickness as it approaches its upper edge portion and merges at the upper edge portion into said surface, which apparatus comprises a tank adapted to contain electrolyte at a predetermined level, a depending rotatable chuck for supporting the vessel, a traveling supporting carrier for the chuck, a series of anodes in said tank in spaced relation to each other, supporting means for said traveling supporting carrier adjacent each of the several anodes of said series, said supporting means being at progressively greater predetermined elevations in the direction of travel of said traveling supporting carrier, power driven means for automatically intermittently moving said traveling supporting carrier successively onto said progressively elevated supporting means for positioning said chuck successively above the several anodes of said series at progressively increasing predetermined elevations with respect to such electrolyte, power driving means mounted on said supporting carrier for rotating said chuck and means for supplying power to power driving means when said traveling supporting carrier is supported by said supporting means.

4 claims, 23 figures.

References cited: U. S. Patents 75,258; 234,775; 1,298,155; 1,453,419; 2,044,431; 2,098,813; 2,138,938; 2,363,973. British Patents 4,120; 17,717.

No. 2,509,117, May 23, 1950—Method of Making Composite Wire—E. H. Wallace, assignor to U. S. Rubber Company.

Aluminum wire, because of its high electrical conductivity and lightness, is particularly useful as a medium for conveying electrical energy. However, aluminum wire as such possesses the objectionable feature of being difficult to solder, such as the formation of good electrical joints. . . .

In general, my invention includes the steps of treating aluminum wire in such a manner as to permit the adhesion of electrodeposited iron. After the iron is deposited, the coated aluminum wire is treated by tinning the surface of the electrodeposited iron. . . .

The reason for providing the aluminum wire with a thin film of iron electrodeposited upon the alumi-

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num is that tin will not bond satisfactorily to an aluminum surface.

CLAIM. The method of forming a tinned aluminum conductor wire of composite laminae in which adjacent layers of deposited metals are securely bonded together comprising the steps of cleaning the aluminum wire with a solution containing a small amount of chromic oxide and sulfuric acid, then immersing the wire in a solution of alkali metal carbonate and a chromate to provide an oxide coat on the aluminum, then treating the wire with nitric acid to etch the oxide coat, then electrodepositing a layer of iron on the etched surface, and finally applying over the iron a protecting coating of tin.

1 claim, 2 figures.

References cited: U. S. Patents 440,952; 628,770; 1,975,818; 1,988,645; 2,055,393; 2,162,789; 2,233,410. British Patents 3,439; 548,330.

No. 2,510,128, June 6, 1950—Method of Plating Metals with Zirconium—R. S. Winer, Jr. and L. E. Klekamp, Jr., assignors to Tung-Sol Lamp Works, Inc., Newark, N. J.

An object of this invention is the novel nonaqueous medium containing in solution a compound of the metal to be deposited . . .

EXAMPLE I

With a nonaqueous electrolyte composed of 50 grams of n-butyl alcohol and 2.5 grams of zirconium oxychloride, a cathode of copper was plated with zirconium utilizing direct current at a current density of approximately 12 milliamperes per square centimeter (11 asf) of cathode surface.

EXAMPLE II

190 ml (154 grams) Redist n-butanol
7.6 g $ZrOCl_2 . 8H_2O$
1.0 ml saturated HCl in n-butanol
26 ma/cm² (24 asf)

The desired degree of plating was obtained by carrying on the plating operation for from one to two hours.

CLAIM 15. The method of plating metals with zirconium comprising the electrodeposition upon a

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15 to 25 VOLTS
1— 200 A., 15 V. Master
1—1000 A., 15 V. Gen. Elec.
1— 300 A., 15 V. Star
1— 750 A., 20 V. M. G. Corp.
1— 800 A., 22/33 V. Gen. Elec.

24 VOLTS
2—1500 A. Century
1—2500 A. Gen. Elec.
2—3000 A. Electric Products

1— 600 A., 24 V. Reliance
1— 200 A., 25 V. Star
1— 300 A., 25 V. Star
1— 175 A., 25 V. Cr. Wh.

32 to 60 VOLTS
1— 500 A., 32 V. Columbia
2— 100 A., 30 V. Gen. Elec.
1— 200 A., 30 V. West.
2— 200 A., 32 V. Gen. Elec.
2—1500 A., 32/40 V. Century
1—1000 A., 33 V. Gen. Elec.
2— 500 A., 40 V. Chandeysson
2—1000 A., 40 V. Chandeysson
2— 200 A., 42 V. Gen. Elec.
3—1500 A., 45 V. Century
1—1500 A., 50 V. Gen. Elec.
2— 800 A., 50 V. Gen. Elec.
1— 400 A., 50 V. Gen. Elec.
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cathode, formed of a metal below hydrogen in the electromotive series, of zirconium reduced by electrolysis in a nonaqueous solution of butyl alcohol and electrolytically reducible chloride of zirconium, said cathode being formed of copper.

15 claims, 1 figure.

References cited: U. S. Patents 902,755; 1,801,629; 1,922,847; 1,927,773. Trans. Electrochem. Soc. **70**, 431, 432 and 439 (1936).

No. 2,511,395, June 13, 1950—Process for the Electrodeposition of Tin Alloys—S. W. Baier, D. J. Macnaughtan, London, England, assignors to The City Auto Stamping Company, Toledo, Ohio.

Using, as an example, a bath for the deposition of a tin-copper alloy, we have found the following composition to be quite applicable.

Tin (as sodium stannate), g/l	10–100
Copper (as sodium cuprocyanide), g/l	2–20
Free cyanide (as sodium cyanide), g/l	5–30
Rochelle salts, g/l	10–100

Free caustic to give a *p*H in excess of 13

However, for best commercial control and for best results, we prefer to use a bath within the following composition range:

Tin (as sodium stannate), g/l	35–65
Copper (as sodium cuprocyanide), g/l	5–15
Free cyanide (as sodium cyanide), g/l	10–20
Rochelle salts, g/l	20–50

Free caustic sufficient to give a *p*H from 13.4 to 13.6

. . . we employ separate anodes of tin and copper . . . and we prefer to use separate anode circuits so that the current throughout be separately controlled . . . we have found it desirable to pass approximately 70 per cent of the total current through tin anodes and 30 per cent through copper anodes.

Current densities on the copper anodes . . . we prefer to maintain at a value of from 10 to 20 amperes per square foot . . . a current density of at least 10 amperes per square foot must be maintained on the tin anodes . . . at all times it is in the plating solution.

In general, a voltage drop of from 2 to 3 volts is desired between the copper anode and the cathode, while the drop between the tin anode and the cathode should be at least 1 volt higher than that between the copper anode and the cathode.

PROCEDURE

Starting

1. Load work or dummy cathodes on cathode rod
2. Insert copper anodes on anode bar
3. Switch current onto copper anodes immediately after they have been inserted
4. Switch current on for tin anodes

Reloading

Unload plated articles one rack at a time and replace with fresh work so that a load is always maintained on the cathode bar.

Final unloading

1. Lift out tin anodes
2. Switch off current from tin anodes
3. Switch off current from copper anodes
4. Remove copper anodes as soon as current has been turned off
5. Remove plated work

CLAIM 1. The process of electrodepositing an alloy of the class consisting of copper, cadmium and zinc composed essentially of tin and an alloying metal and antimony from an aqueous electrolyte consisting essentially of 10–100 grams per liter of soluble tin compound in stannate form and 2–20 grams per liter of a cyanide-soluble compound of said alloying metal, using a soluble tin anode, a separate soluble anode of said alloying metal, and a cathode upon which the alloy is deposited, comprising forming on the surface of said tin anode an electroconductive surface film and maintaining at all times when said tin anode is in contact with said electrolyte a substantially uninterrupted flow of current, the current density on the tin anode being from 10 to 40 amperes per square foot during the electrodeposition of said alloy, the current density on said anode of alloying metal being from 10 to 25 amperes per square foot and the cathode current density from 20 to 100 amperes per square foot.

11 claims, 1 figure, 8 examples.

References cited: U. S. Patents 1,918,605; 1,919,000; 1,970,549; J. Electrodepositors' Tech. Soc. **11**, 15–22 (1935–1936); **15**, 1–30 (1939). Hansel, Z. Elektrochem. **41**, 314–321 (1935). Baier, Pub. No. 92, Intern. Tin Research and Developm. Council, p. 5 (April, 1939). Metals Handbook, Am. Soc. Metals, 1939 ed., pp. 1364, 1365.

No. 2,512,328, June 20, 1950—Continuous Electroplating Device—N. E. Hays, assignor to Armco Steel Corporation.

CLAIM 1. An apparatus for rapid continuous electroplating, comprising a short plating tank having a pair of opposite walls provided with horizontal openings through which sheet metal to be electroplated may be passed flatwise in a horizontal path of travel and through which electrolyte leaves said tank, a longitudinal conduit having transverse openings in communication with the interior of said plating tank, said transverse openings being substantially at the level of said path of travel, directed toward said path of travel, and adjacent an edge of said metal to be plated, pump means for delivering electrolyte to said tank through said conduit and its said transverse openings so as to produce rapid circulation of the electrolyte over all surfaces of said sheet metal and at a rate to maintain an electrolyte level above said sheet metal and said horizontal openings, wiping means engaging the sheet metal adjacent said horizontal openings but beyond said tank to remove electrolyte therefrom and direct the electrolyte into receiving means, anodes in said plating tank above and below said path of travel, and means for making contact with said sheet metal located adjacent but beyond said wiping means.

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11 claims, 4 figures.

References cited: U. S. Patents 1,768,358; 2,307,928; 2,326,624; 2,377,550; 2,382,018; 2,399,254. British Patent 479,896.

No. 2,512,554, June 20, 1950—Electroplating Rack—M. S. Schneider.

CLAIM 1. A rack for supporting articles in an electroplating or like bath having a bus bar common to a plurality of racks comprising in combination an elongated metallic body including a portion for supporting the rack with respect to the bus bar, said body having an electrically nonconducting coating thereon coextensive with at least that portion of the rack normally immersed in the bath, a plurality of members detachably secured to the body, each said member including a U-shaped yoke embracing the body at a selected location thereon and having a threaded aperture in at least one of the legs of said yoke, an article-supporting arm carried by said yoke and having a threaded portion in engagement with said aperture, said threaded portion terminating at its free end in a point puncturing said coating thereby securing said yoke to said body and providing an electrical path from said body to said arm.

3 claims, 11 figures.

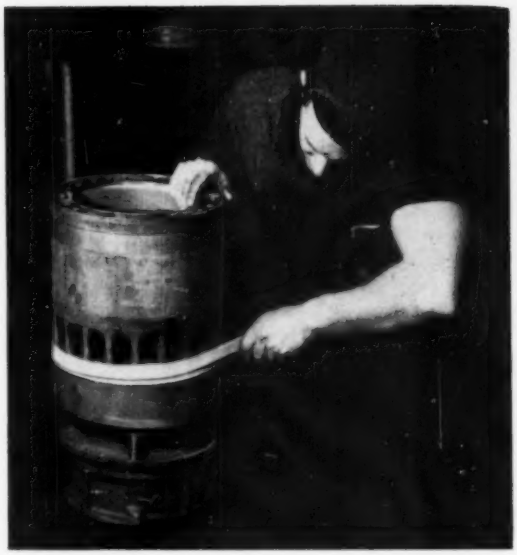
References cited: U. S. Patents 988,104; 1,068,410; 1,091,185; 1,481,075; 1,738,515; 1,755,122; 2,058,365; 2,121,144; 2,140,614; 2,253,576; 2,258,391; 2,267,449; 2,330,365; 2,364,822. French Patent 493,525.

No. 2,512,563, June 20, 1950—Method of Electrolytically Coating Magnesium and Its Alloys—H. K. De Long, assignor to Dow Chemical Company.

CLAIM 1. The method of producing an abrasion-resistant coating upon an uncoated article of magnesium and its alloys containing at least 80 per cent of magnesium which comprises anodically electrolyzing the article in an aqueous solution the dissolved constituents of which consist essentially of an alkali-metal borate in amount between 80 grams per liter and that producing saturation, an alkali-metal silicate in amount between 5 and 100 grams per liter and from 1 to 50 grams per liter of a water-soluble organic compound selected from the group consisting of methyl alcohol, ethyl alcohol, ethylene glycol, diethylene glycol, mannitol, phenol, sodium phenate, the *p*H of the solution being between about 10 and 12 and the electrolyzing potential being raised gradually from the initial value of between 0 and about 35 volts so as to produce a current density between about 5 and 40 amperes per square foot of surface of the article during the electrolysis, and discontinuing the electrolysis when the applied voltage reaches a value between 80 and 150.

2 claims.

References cited: U. S. Patents 1,800,206; 2,196,161; 2,203,670; 2,276,286. Appl. Ser. No. 268,694 to Berthier (A. P. C.) published June 8, 1943. Australian Patent 21,307. British Patent 459,017; 483,798. Hackh, "Chemical Dictionary, 2nd ed. (1937), p. 737.



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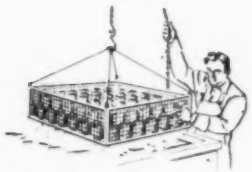
News about UNICHROME Trade Mark COATINGS for METALS



Bright, corrosion-resistant DIP FINISH for zinc

The Unichrome Dip Process—a chemical treatment—brightens zinc plate to chromium-like luster and protects it from dulling. Also used to chromate-treat zinc die castings. It provides both *economy* and *quality* in finishing wire goods, screws, nuts, bolts, and a variety of other products.

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Do you know that Ucilon* Coating Systems are available to withstand fumes or constant contact with such coating-destroying chemicals as acids, alkalies, cleaners, plating baths, salt solutions, petroleum derivatives, water, oxidants and other corrosives? Many platers do know this and are benefiting by longer-lasting protection and savings on maintenance.

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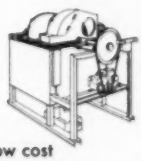

How to chromium plate SMALL parts in volume and at low cost

A 24-inch, batch-type chromium plating barrel, developed by United Chromium, is skyrocketing output and minimizing finishing costs. In one plant, 500,000 small parts are plated in one day by one barrel and one operator!

At Last! Bright Chromium Plating over a wider current range!

Unichrome Self-Regulating High Speed Chromium Bath is reducing rejects and finishing-costs

Plated in S.R.H.S. Chromium, this part shows how wider bright plate range assures better chromium plating
Coverage obtained in this recess
. . . without any "burning" on projections

Uniform, bright plating of irregular or large pieces—frequently a problem in conventional chromium solutions—is being achieved with consistency in the Unichrome S.R.H.S. Bath. Possessing wider bright plate range, this solution permits use of ample current to avoid "missing" without "burning." For example:

In plating round-shaped auto exhaust deflectors, **an Ohio metal finishing company** found that S.R.H.S. Chromium not only reduced rejects due to "missing," but also needed less current to do the job—thereby eliminating "burning," and saving power.

For an Indiana manufacturing company, Unichrome S.R.H.S. Chromium on nickel has eliminated 50% of former coloring required after chromium plating—again because this bath "burns" less without "missing."

An Illinois plating shop, through the use of S.R.H.S. Chromium, ended "missing" and "burning" on large hard-to-plate stove tops. As a result, they also have eliminated the labor of color-buffing this unwieldy work.

Fewer rejects and consistently better plating made possible by the S.R.H.S. bath help greatly to reduce operating costs in any plating plant. S.R.H.S. Chromium has other important advantages. It plates faster than conventional solutions — sometimes cutting time in half. It is self-regulating—assuring peak throwing power and a more foolproof bath.

Write for new bulletin which gives more information. Or better still, have an engineer from "Coatings for Metals" headquarters show how *you* can boost output and cut the cost of meeting your chromium plating specifications.

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1950-1951

WILLIAM J. NEILL

President

Born on July 1, 1901, and attended school in a great many cities due to his father's business. Franklin University is his alma mater.

General Superintendent of Columbus Metal Products Company, manufacturers of oil burner and truck and bus equipment.

Past President (two terms) of the Dayton Branch; instrumental in organizing the Columbus Branch. Member of American Institute of Chemists and Vice-Chairman of its Miami Valley Chapter; member of the Board of Governors of the Ohio Committee for Professional Practice; member and Past Officer of Kiwanis International.

FRANKLYN J. MacSTOKER

Second Vice-President

A native of Brooklyn, N. Y., attended elementary and high school in that city, and studied chemistry and metallurgy at Brooklyn Technical Institute and Cooper Union School of Science, New York City.

Electroplating Supervisor and Finishing Engineer with New York manufacturing concerns; travelling representative of Magnus Chemical Company, Brooklyn, N. Y., and Colonial Plating Equipment and Supply Company, Boston, Mass.; now Finishing Superintendent, Farrand Optical Corporation, Bronx, N. Y.

New York Branch A. E. S. member 1922; President 1928-1930, Secretary-Treasurer 1934 to date; member A. E. S. Award Committees 1930–1936; General Chairman, A. E. S. Silver Jubilee, New York City, 1937; A. E. S. First Vice-President 1938; member A. E. S. Research Committee 1940–1944, A. E. S. Constitution Revision Committee 1947–1948.

ARTHUR W. LOGOZZO

Past President

Formerly Foreman Plater, General Electric Company, Pittsfield, Mass.; Plating Superintendent, Hartford Chrome Corporation, Hartford, Conn.; Service Engineer, MacDermid, Incorporated, Waterbury, Conn.; now President of Nutmeg Chrome Corporation, Hartford, Conn.

Past President of Hartford Branch, A. E. S.; recipient of First Exhibit Prize at the 1941 Convention for a display of chromium-plated dies and molds. Winner of the Coffin Award, General Electric Company's highest award for contribution to the electrical art, for development of mold-plating methods.

C. F. NIXON

First Vice-President

Born in Philadelphia, Pa., on May 4, 1901; graduated from the University of Wisconsin in 1923 with a B.S. in chemical engineering.

Employed in the laboratory of Western Electric Clock Company, Peru, Ill., for six years; since then with Ternstedt Division of General Motors Corporation, where he is now Director of Process Engineering.

Member of the American Electroplaters' Society since 1924; Past President of Detroit Branch. Contributed many papers on electroplating subjects and received several awards.

GEORGE P. SWIFT

Third Vice-President

Born in Boston, Mass., on August 9, 1903; S.B., 1924, and S.M., 1928, in electrochemical engineering, Sc.D. in metallurgy, 1944, all from M. I. T.

Taught physics and metallurgy at M. I. T. 1924–1944; began independent consulting practice in 1930; since 1944 operates electrochemical and spectrographic laboratories in Watertown, Mass.; Director of Alice Ames, Inc., Boston; Executive Secretary, Master Metal Finishers' Association, since 1947.

Officer of Boston Branch, American Electroplaters' Society, since 1941; President 1942–1945; Assistant to Secretary-Treasurer, 1945–1946; Secretary-Treasurer, 1946– . Officer, Boston Section, and Director, A. I. M. E. Active in A. S. T. M. and other societies.

A. KENNETH GRAHAM

Executive Secretary

Born December 25, 1896, Philadelphia, Pa.; attended University of Pennsylvania and Columbia University; holds B.S., M.S., and Ph.D. from University of Pennsylvania.

Research work, Scovill Manufacturing Company, Waterbury, Conn., 1919–1920; Instructor in Chemistry, University of Pennsylvania, 1921–1926; Chemical Engineer, H-VW-M Company, 1926–1928; Instructor and Assistant Professor in Chemical Engineering, University of Pennsylvania, 1928–1937; Consultant, A. K. Graham and Associates, 1936–1942; Consultant and Deputy Chief, Products Branch, Conservation Division, W. P. B., 1942–1943; Director of Research and Development, Garfield Division, Houdaille-Hershey Corporation, 1943–1944; President, Graham, Crowley and Associates, Inc., 1944 to date.

Convention Echoes

International Fellowship Club

This organization of supply house representatives, although not a part of the A. E. S., for years has contributed much to the success of the A. E. S. Conventions. Such was the case also in Boston.

Under the guidance of its president, Rudy Hazucha of the Clinton Supply Company, Chicago, and its secretary, Tom Trumbour of Finishing Publications, Inc., New York City, it had arranged an Open House on Monday evening which started off the social activities in a truly grand fashion. There were dancing to an excellent orchestra and liquid refreshments throughout the evening, and a buffet was served at 10:00 P. M. Every half hour a door prize was distributed: a complete set of Oneida sterling tableware, a solid-silver Wallace tea set, and seven Government bonds.

The Club also made its special bow to the ladies with the "Plato" Party held during the Outing and Clambake at Nahant Beach. At this affair, under the direction of Joan Trumbour Wiarda, every lady received a set of bridge cards as a favor. The prizes included an electric clock, trays, an ice crusher, a silent butler, a table lamp, salt and pepper shakers, a case of Oakite, a water pitcher, a set of kitchen knives, to mention only a few, and compacts as consolation prizes, all much appreciated by the contestants.

At its Annual Luncheon Meeting on Monday noon, George L. Nankervis of George L. Nankervis Company, Detroit, Mich., was elected President; A. P. Munning of Munning & Munning, Inc. Newark, N. J., First Vice-President; Arthur Braun of Agate Lacquer Company, Long Island City, N. Y.; Second Vice-President; and Charles L. Berry of Maas & Waldstein, Chicago, Third Vice-President. Tom Trumbour was re-elected Secretary for the twentieth time.

Nankervis

The Club held its Annual Golf Tournament on Wednesday at the Tedesco Country Club, Swampscott, with J. J. Duffy, Jr. of Pennsylvania Salt Manufacturing Company as chairman. Over 100 "golfers" participated. Using the Calloway system of Automatic Handicap, the Club announced the following winners: For low net: Walter Cibulskis, United Chromium, Inc., Detroit (113 − 42 = 71)—trophy; Mrs. C. W. Gore, New England Buff Company, Boston (116 − 45 = 71)—golf bag; John Trumbour, Finishing Publications, Inc., New York City (119 − 48 = 71)—traveling bag; Cliff Heckenberg, New England Buff Company, Boston (127 − 56 = 71)—sport seat. Low gross: Rudy Skrilletz, H. B. Satter Manufacturing Company, Marysville, Ohio (80 − 7 = 73)—golf balls. Highest handicap: Harold Stevens, Towle Silver Company, Newburyport, Mass. (136 − 64 = 72). In addition, gloves were won by Mrs. G. N. McNealy, Bacon Felt Company, Winchester, Mass. (121 − 46 = 75); Bob Feinberg, Beacon Supply Company, Chelsea, Mass. (81 − 9 = 72); and Joe Powell, Lewis Chemical Company, Lynn, Mass. (139 − 63 = 76), who also won the title of Most Courageous Golfer.

Convention Contributors

Anyone who read the Convention program would realize that the registration fee of $10.00 would not by any means cover the cost of the Convention. The additional cost was borne by a number of supply houses and others who felt that the success of the Convention was important to the industry they serve.

The Society is pleased to acknowledge its indebtedness to the following:

Acme Mfg. Co., Detroit, Mich.
Advance Polishing Wheels, Inc., Chicago, Ill.
Agate Lacquer Mfg. Co., Inc., Long Island City, N. Y.
Allied Industrial Products Co., Chicago
Alsop Engineering Corp., Milldale, Conn.
American Buff Co., Chicago, Ill.
Apley N. Austin Co., Boston, Mass.
Automotive Rubber Co., Detroit, Mich.
Azed, Inc., Waukegan, Ill.
Bacon Felt Co., Winchester, Mass.
Baker & Co., Inc., Newark, N. J.
Bart-Messing Corp., Brooklyn, N. Y.
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Chemclean Prods. Corp., New York, N. Y.
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Nelson Chemicals Corp., Detroit, Mich.
G. J. Nickolas & Co., Inc., Bellwood, Ill.
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The Puritan Mfg. Co., Waterbury, Conn.
Roto-Finish Co., Kalamazoo, Mich.
The Seymour Mfg. Co., Seymour, Conn.
Solventol Chemical Products, Inc., Detroit, Mich.
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Frederic B. Stevens, Inc., Detroit, Mich.
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The Udylite Corp., Detroit, Mich.
United Chromium, Inc., New York, N. Y.
U. S. Stoneware Co., Akron, Ohio
Van der Horst Corporation of America, Olean, N. Y.
Waterbury Plating Co., Waterbury, Conn.
Wyandotte Chemicals Corp., Wyandotte, Mich.

AT THE REGISTRATION DESK: (1) *Marion Longfield, Chicago; Mrs. and Mr. Les Direley, Milwaukee; A. P. Weisberg, St. Louis; and Bruce E. Warner, Worchester, Mass.; facing Edmund Jevely, Boston (Convention Entertainment Chairman).* (2) *Mrs. and Mr. W. M. Phillips, Detroit, in background; Walter L. Larsson, Boston (Hotel Reservations Chairman), Mrs. George P. Swift, Boston.* (3) *Hugh MacLeese, Detroit; Fred R. Grover, Rockport, Mass.; Arthur Collins, Boston (Convention Publicity Chairman); Edmund Jevely; A. E. Carlson and Clifford Struyk, Edgewater, N. J.; Dr. H. L. Kellner, Waterbury, Conn.*

THE OPENING SESSION: (4) *General Chairman Manson Glover tells about Boston.* (5) *Jack Brown welcomes President A. W. Logozzo, Hartford, Conn., for Mayor Hynes.* (6) *Executive Secretary Dr. A. Kenneth Graham reports.* (7) *Boston Branch President Louis Gagnon likes the turn-out.* (8) *Daniel Gray, Oneida, N. Y., delivers keynote address.* (9, 10) *Convention Co-Chairman Dr. George P. Swift welcomes Founder Members George B. Hogaboom, Bridgeport, Conn.; E. W. K. Faint, Morris Plains, N. J.; John E. Sterling, Patterson, N. J.; Charles A. Cooper, Baldwin, L. I., N. Y.; William J. Schneider, New York City; Horace H. Smith, Newark; and Thomas A. Trumbour, New York City.* (11) *President Logozzo welcomes J. J. Dale, Australia.* (12) *Herbert Marston and George H. Turner, Birmingham, England, flank President Logozzo.* (13) *Jan van der Graaf, Holland, is introduced*

THE EDUCATIONAL SESSIONS: (14) *Drs. Samuel Haiman, Philadelphia, and William Blum, Washington, D. C., in foreground;* (15) PLATING*'s editors, Gustaf Soderberg and Dr. Harold J. Read, in front*

BETWEEN SESSIONS: (16) *Stanley Harris, New York City; Ed Lankes, Hartford, Conn.; Earl W. Couch, Waterbury, Conn.; F. A. Infield, Schnectady.* (17) *W. J. English, Ansonia, Conn.; M. E. Powers, Boston; Ray O'Connor, Bridgeport.* (18) *Fred R. Grover, Rockport, Mass.; Arthur W. Collins, Boston; Dr. C.*

Fred Gurnham, Medford, Mass. (19) *Henry Strow, Martin M. Sternfels, W. L. Cassell, and W. D. Gordon, all of Waterbury, Conn.; Vernon Julianne, Long Island City, N. Y.* (20) *A. Korbelak, Bloomfield, N. J.; R. Sizelove, Kearny, N. J.; Harold Narcus, Worchester, Mass.; Edmund Jevely, Boston.* (21) *John Gumm, Kearny, N. J.; Harry Bedrossian; Frederick Gumm, Kearny, N. J.; Joseph Sexton, New Haven, Conn.* (22) *George Wagner, Newark; Carl E. Heussner, Detroit; Horace H. Smith, Newark; Don Bedwell, Los Angeles.* (23) *Jack Coros, Coraopolis, Pa.; Paul and Gus Schaffner, Emsworth, Pa.; Leo J. Schmitt, Pittsburgh, Pa.; F. R. Keller, Newton Falls, Ohio*

THE PLATED WARE EXHIBIT: (24) *Arthur Mintie, Boston, and Milton Nadel, Long Island City, N. Y., at right.* (30) *Henry Strow at extreme left.* (31) *Dr. H. L. Benner, Wilmington, Del., talks to Thomas A. Trumbour, New York City, beside Detroit Branch's historical exhibit*

THE BOSTON POPS CONCERT: (32) *Conductor Arthur Fiedler in action.* (33) *Mr. and Mrs. Allen Chabot in foreground.* (36) *Vice-President C. F. Nixon, President and Mrs. A. W. Logozzo, Mrs. Nixon, Martha Glover, Mrs. Harold J. Read*

THE BANQUET: (38) *Marjorie Swift, Boston; Past President and Mrs. Logozzo, and George B. Hogaboom at speakers table; M. E. Baker and Mrs. Steven Baker, Cambridge, Mass.* (39) *Georg W. Jernstedt, East Pittsburgh, Pa., in left background.* (40) *Dr. H. L. Kellner gets the joke.* (41) *Newly elected President and Mrs. William J. Neill, Columbus, Ohio, at speakers table; Horace H. Smith, Newark.* (42) PLATING'S *Advertising Manager, Walter C. Dietrich, at left.* (43) *Mrs. and Mr. Adolph Bregman, New York City, center; Oscar F. Pearson, Boston; Richard F. Teeling, Passaic, N. J.; Dr. Gardner D. Foulke, Malawan, N. J.* (44) *Mrs. Abbot; M. Longfield and Mrs. and Mr. O. W. Waarick, Chicago.* (45) *Daniel Gray, Oneida, N. Y., with his A. E. S. Leather Medal for outstanding work at the Opening Session*

A. E. S. News

New Sustaining Members

The list of Sustaining members continues to grow largely through the efforts of the Branch Research Committees.

The following have joined since the last publication:

American Cabinet Hardware Corporation, Rockford, Ill.

American Nickeloid Company, Peru, Ill.

Bruce Products Corporation, Howell, Mich.

Clayton Mark & Co., Evanston, Ill.

Ekco Products Company, Chicago, Ill.

Felt & Tarrant Manufacturing Company, Chicago, Ill.

C. Hager & Sons Hinge Mfg. Co. St. Louis, Mo.

Metal Processing Co., Chicago, Ill.

Michigan Bumper Corporation, Grand Rapids, Mich.

Michigan Chrome & Chemical Company, Detroit, Mich.

Modern Plating Company, Inglewood, Calif.

Northwestern Plating Works, Chicago, Ill.

Perma-Line Rubber Products Corporation, Chicago, Ill.

Philco Corporation, Philadelphia, Pa.

Research Committee

Three members of the Society have been appointed by the Executive Board to serve three-year terms on the Research Committee. They are Clyde Kelley, Driscoll Company, Chicago, Ill.; Dr. Donald Price, Oakite Products, Inc., New York City; and George W. Jernstedt, Westinghouse Electric Corporation, East Pittsburgh, Pa. They replace William M. Tucker, retiring Committee Chairman; Bernard C. Case, retiring Chairman of the Research Directing Subcommittee; and Leonard Weeg, who completed their three-year term with distinction.

The new Committee Chairman, Dr. W. A. Wesley, has announced the appointments of Guy M. Cole as Vice-Chairman, Research and Chairman, Research Directing Subcommittee, and of Herman J. Struckhoff as Vice-Chairman, Finance and Chairman, Finance and Publicity Subcommittee. The appointments are for a 12-month period. Messrs. Cole and Struckhoff will announce their appointments of subcommittee vice-chairmen and members.

Law Committee

President W. J. Neill has announced the reappointment of Manson Glover, Glover Coating Company, Malden, Mass., as Chairman of the Law Committee, with authority to appoint other members of the committee.

The Law Committee is charged with the task of receiving all proposed amendments to the Society's Constitution and of seeing to it that they are properly worded and classified. It has also reviewed By-Laws of Branches.

Chicago Industrial Finishing Exposition 1952

At its meeting on June 16, the Executive Board appointed C. C. Kelly, Driscoll Company, Chicago, Ill., Chairman and H. E. Head, Briggs Manufacturing

Kelly

Head

Company, Detroit, Mich., Vice-Chairman of the Exposition Committee. Mr. Kelly has served as Temporary Chairman during the past year, and Mr. Head was Co-Chairman of the very successful Detroit Exposition in 1947.

They are to report soon to the Board on plans of organization, policy, and procedure.

Back Issues of The Monthly Review

Mr. L. R. Eastman, Manager of the Buffing Composition Department of Frederic B. Stevens, Inc., subsidiary of The Udylite Corporation, and Mr. C. W. Smith of Whitfield Chemicals, both of Detroit, Mich., have kindly sent a number of copies of The Monthly Review to the Executive Secretary's office in Jenkintown, Pa.

They will be used to complete files in libraries of Branch cities.

Additional Branch Speakers

THE HARSHAW CHEMICAL CO. (c) 1945 E. 97th St., Cleveland 6, Ohio—Middle Atlantic and Midwest

Dr. M. M. Beckwith, Manager, Technical Sales—Electroplating

A. H. Du Rose, Technical Service—Electroplating

Subject to be selected

THE INTERNATIONAL NICKEL CO., INC. (c) 67 Wall St., New York 5, N. Y. —East, Midwest and Far West

Walter H. Prine

Subject:

Industrial Nickel Plating, Applications and Operations.

Information on Transportation to the Los Angeles 1951 A. E. S. Convention

This report is primarily concerned with low cost rail travel and air travel. No information is included regarding regular Pullman, tourist Pullman, or a special train. It will be furnished later.

Low Cost Rail Travel

From Chicago

Via Sante Fe Railroad's "El Capitan" De Luxe Reserved Seat Streamlined All Coach Train. Leaves daily at 5:30 P. M., arrives the second morning at 7:30 A. M. Time in transit 39 hours.
Total round-trip cost, including tax $104.94
Total one-way cost, including tax. 61.86

Via Union Pacific Railroad's "Streamliner" De Luxe Reserved Seat Streamlined All Coach Train. Leaves daily at 7:15 P. M., arrives the second morning at 9:00 A. M. Time in transit 39¾ hours.
Total round-trip cost, including tax $104.94
Total one-way cost, including tax. 61.86

Via Union Pacific Railroad's "L. & Limited" Daily Reserved Seat Coach Train. Leaves at 12:01 Noon, arrives second morning at 10:45 A. M. Time in transit 48 hours.
Total round-trip cost, including tax. $93.43

From New York

Via New York Central Railroad's "Pacemaker" De Luxe Reserved Seat Streamlined All Coach Train. Leaves daily at 3:30 P. M., arrives in Chicago at 7:30 A. M. and connects with aforementioned Sante Fe or Union Pacific coach trains. From New York to Los Angeles 3 nights en route.
Total round-trip cost New York City to Los Angeles, including tax $151.51

From Detroit

Via New York Central Railroad's "Mercury" Daily Reserved Seat Streamlined Coach Train. Leaves at 8:30 A. M., arrives in Chicago at 12:45 Noon and connects with aforementioned Santa Fe or Union Pacific coach trains. From Detroit to Los Angeles 2 nights en route.
Total round-trip cost Detroit to Los Angeles, including tax $122.07

Air Travel

From Chicago

Via Trans World Airlines "Sky Coach" regularly scheduled 80-passenger 4-engine Lockheed Constellations. Flying time 7 hours.
Total round-trip cost, including tax $195.50

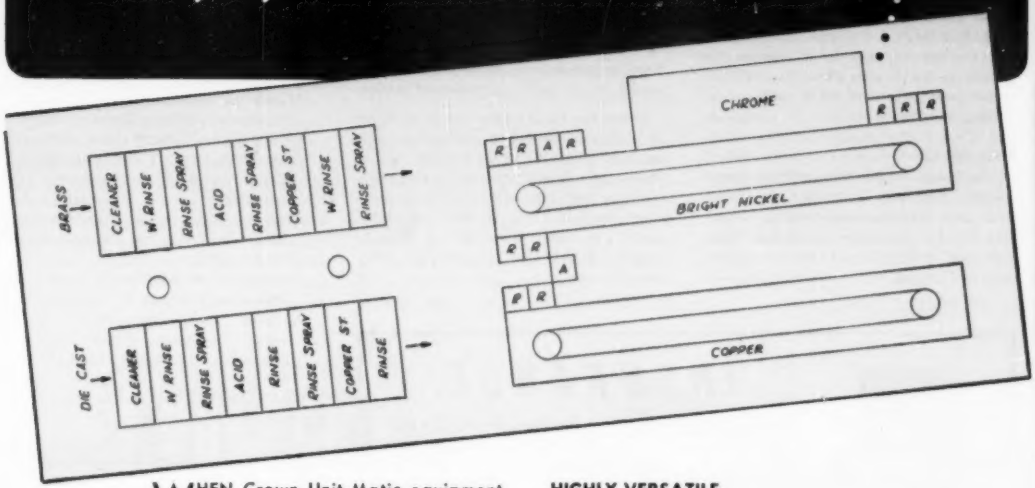
Via American Airlines "Sky Coach" regularly scheduled 80-passenger 4-engine Douglas DC-6's. Flying time 7 hours.

(*Continued on page 880*)

CROWN

UNIT-MATIC mechanized plating

Brings you MANY ADVANTAGES



WHEN Crown Unit-Matic equipment mechanized the cleaning and plating operations in this Plating Shop it brought many advantages . . . lower costs . . . improved quality . . . higher production . . . more profits.

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Whether your production is 40 racks of work per hour or 400 racks per hour you can mechanize your electro plating department with Crown Unit-Matic Plating Equipment.

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The layout shown here processes DIE CAST and BRASS parts, as well as a few steel parts. Any of the cleaning, copper Plating, Brite Nickel or the chrome Plating treatments, or the time cycle, can be quickly changed without disturbing the other treatment cycles.

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A. E. S. News

(*Continued from page 878*)

Total round-trip cost, including tax $195.50

Via Trans World Airlines regularly scheduled 52-passenger 4-engine Lockheed Constellations. Flying time 7 hours.
Total round-trip cost for 1 person, including tax..... $248.63
Total round-trip cost for 2 persons, including tax (Family Plan)..... $392.50
Total round-trip cost for 3 persons, including tax (Family Plan)..... $523.36

Via American Airlines regularly scheduled 52-passenger 4-engine Douglas DC-6's. Flying time 7 hours.
Total round-trip cost for 1 person, including tax..... $248.63
Total round-trip cost for 2 persons, including tax (Family Plan)..... $392.50
Total round-trip cost for 3 persons, including tax (Family Plan)..... $523.36

From New York

Via Trans World Airline 80-passenger 4-engine Lockheed Constellation or American Airlines 80-passenger 4-engine Douglas DC-6's regularly scheduled "Sky Coaches." Flying time 12 hours, stopping only at Chicago.

Total round-trip cost, including tax $253.00

Via Trans World Airlines 52-passenger 4-engine Lockheed Constellation or American Airlines 52-passenger 4-engine Douglas DC-6's. Regularly scheduled. Flying time 12 hours, stopping only at Chicago.
Total Round-trip cost for 1 person, including tax..... $345.00
Total round-trip cost for 2 persons, including tax (Family Plan)..... $544.64
Total round-trip cost for 3 persons, including tax (Family Plan)..... $726.23

NOTES

For 1 person "Sky Coach" is cheapest. Sky Coaches do not serve meals en route. When two persons travel together regular fares are almost the same as Sky Coach fare if advantage is taken of the "Family Plan" on the regular planes. Regular planes serve meals en route and provide more space per passenger carried.

Under the Family Plan one must travel on Monday, Tuesday or Wednesday. Under this plan the first member of the family pays 1 full fare, additional members pay half fare each. Three or more people travelling on regularly scheduled planes and taking advantage of "Family Plan" find this plan cheaper than "Sky Coach" travel.

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Branch News

BRIDGEPORT BRANCH

Retiring PRESIDENT CARL SCHAEFER opened the meeting on May 5 with twenty-eight members and guests present and introduced ANTHONY J. CHENIS, the new President. A rising vote of thanks was accorded to Mr. Schaefer for his successful administration.

Three men were elected to membership one in-transfer from New York Branch was accepted, and three resignations were received.

Richard C. Barrett, Chairman, reported for the Branch Exhibit Committee and WILLIAM EHRENCRONA, Chairman, for the Spring Dinner-Dance Committee. The affair will be held at the Fairfield Inn on Saturday, May 27.

President Chenis appointed the following committees:

Membership—MEDWICK J. BRASSARD Chairman; HUBERT CONNER, GEORGE J. ECKHOLM, FRED F. LANCASTER

Sick—HERMAN C. BRAUN, Chairman; FLOYD TATUM, V. S. CONSALVO, ALFRED BACH

Projector—WILLIAM A. EHRENCRONA, Chairman; FLOYD ERLENMEYER, DANIEL D. ZIELIK

Publicity—JOHN SCHNEIDER, JOSEPH G. STERLING, WILLIAM N. LINDSAY, JR.

Technical Session—RICHARD C. BARRETT, Chairman; PHILO BAILIN, RAYMOND J. KWASNIK, CHARLES L. BRYAN

LIBRARIAN RAY W. GORAL then conducted the technical session.

JOSEPH G. STERLING,
Secretary-Treasurer

DAYTON BRANCH

The scheduled speaker for May 5 was unable to be present and the time was devoted to business. The following were elected for the coming year:

President—ELMER W. BEHME
First Vice-President—RALPH CLINEFELTER
Second Vice-President—FRED BAUCH
Secretary—RICHARD M. CLINEHENS
Treasurer—PAUL E. GESKE
Librarian—GORDON R. LYONS
Board of Managers—HERMAN E. AUSTEN, FRANK KLEIN, RICHARD WAYMIRE

R. M. CLINEHENS, *Secretary*

DAYTON BRANCH

There was no regular meeting during the month of June. Instead the Annual June Party was held on June 3 at the Paradise Gardens. This turned out to be a grand affair, and we wish to thank RALPH CLINEFELTER, WALTER MOLINE, and FRANK KLEIN for their fine work in arranging it. As usual we had bad weather, but there were 58 persons present.

The evening included dancing, card

playing, refreshments, and an all-around good time.

R. M. CLINEHENS, *Secretary*

DETROIT BRANCH

Officers for the ensuing year were installed at the meeting on April 14. They are:

President—EDGAR A. HAHN
First Vice-President—
FRANK L. CLIFTON
Second Vice-President—
HERBERTH HEAD
Secretary-Treasurer—JOSEPH GURSKI
Educational Chairman—LESLIE C. BORCHERT

Sixteen new members were admitted, which brings the total membership of the Branch to the five hundred mark.

MR. HAROLD FAINT of the Industrial Filter & Pump Manufacturing Company presented a short talk on the subject of "Filter Aids", showing the latest developments now available to the industry and their various applications.

The main speaker for the evening was MR. J. HOMER WINKLER, Battelle Memorial Institute, Columbus, Ohio, who talked about the many applications of electrodeposition in the printing industry, methods used, and advantages. Emphasis was placed on the more recent developments in the electroforming of electrotypes. His talk was illustrated through the cooperation of the electrotyping industry in Detroit, which added greatly to the presentation.

Refreshments were served after the meeting.

F. J. NEWTON,
Educational Chairman

DETROIT BRANCH
Retiring President C. F. Nixon (left) of the Detroit Branch of the A. E. S. was presented with a pillow by Past President Wright Wilson at the early May meeting of the Branch

LOS ANGELES BRANCH

At the dinner meeting on June 7, seventy members and five guests were present. In line with the new procedure, to handle all Branch business before the educational session, all reports and miscellaneous items were taken care of promptly. Two new members were received.

The program for the evening, planned by LIBRARIAN MORTON SCHWARTZ, was a panel discussion of nickel plating. The panel was composed of EARLE ARNOLD of L. H. Butcher Company, JOHN MANNING of Sundmark Supply Company, and HAROLD KROESCHE of The Harshaw Chemical Company. Mr. Arnold spoke about the constituents of nickel baths and their functions, covering nickel salts, boric acid, wetting agents, and brighteners. Mr. Manning discussed control of operating conditions, such as *p*H, current density, agitation, and temperature. Mr. Kroesche covered the influence of metallic impurities in bright-nickel plating, pointing out the effects of contamination by iron, zinc, copper, chromium, lead, calcium, aluminum, and phosphorus. His talk was supplemented with several interesting photomicrographs showing the structure of nickel deposits from baths with different types of contamination.

The question-and-answer period which followed was very active, aided in part by the beer supplied by the Branch, and covered such subjects as nickel plating high-carbon surgical steels, removal of chromium from nickel solutions, differences between deposits from hot and cold nickel baths, nickel plating stainless steel, nickel thickness *vs.* copper thickness for protection, effect of chromium on the protection afforded steel, and many other subjects. The discussion continued long after the meeting had been adjourned, into the late hours.

GEORGE MCDONALD, *Secretary*

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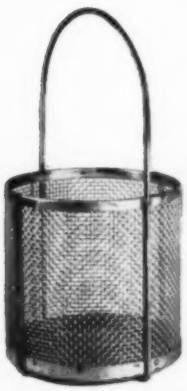

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MELBOURNE BRANCH

Thirty-five members and visitors attended the 52nd regular meeting June 15 in the Metallurgy Theatre of the Melbourne Technical College.

SECOND VICE-PRESIDENT TAYLOR reported the Committee's activities during the past month, which included the organization of the very successful Annual Cabaret Ball, for which approximately 200 tickets were sold. The Ball, which was held at the Dorchester, Melbourne, had brought together representatives from plating shops, supply houses, and A. E. S. members in a friendly atmosphere.

HUGH TEAGUE then introduced MR. J. S. ANDERSON, Assistant Chief Metallurgist, General Motors Holdens, Ltd., who told about "Some Impressions of Plating Plants in U. S. A.". The speaker compared the production of 5,000 cars a day in some American plants with that of 80 cars a day at his own firm in Australia. He highlighted such points of interest in overseas plating practice as equipment, plant layout, control, materials plated, PR plating, anodizing, and the relative merits of cadmium and zinc plating. A lengthy question and discussion period followed.

ROWLAND H. KELLER,
Hon. Assistant Secretary

MILWAUKEE BRANCH

The 410th meeting was held at the Red Arrow Club on June 2.

PRESIDENT H. BORNITZKE reported that the Annual Educational Session and Banquet on April 27 had been financially successful and that the educational session was one of the best ever arranged by the Branch. CHAIRMAN LES DIVELEY led a discussion of the proposed Branch By-Laws, after which the membership voted to accept them as revised by his committee. DEXTER RHODES then inducted the new officers of the Branch and congratulated the retiring officers on their excellent work.

The officers elected for the year 1950-1951 are:

President—LES DIVELEY
First Vice-President—EVERETT ROBINSON
Second Vice-President
KENNETH OLSEN
Secretary-Treasurer—E. E. PIELLUSCH
Librarian—VINCENT MATTICOTTI
Assistant Librarian—FRANK BUSCHNER
Board of Managers—HENRY BORNITZKE
Delegates—Phil J. RITZENTHALER, ROBERT J. STEUERNAGEL, FRED ANDERSON. Alternates: ART NOEL, JOE MOYES, FRANK BUSCHNER

Two men were elected to membership.

MR. R. SESENA of the Osboro Manufacturing Company discussed "Brush Finishing" with the aid of slides, samples, and some very entertaining stories. The subsequent discussion indicated considerable interest in the application of this important tool.

E. E. PIELLUSCH,
Secretary-Treasurer

NEWARK BRANCH

The regular meeting on May 5 began with a 20-minute motion picture. The meeting was then called to order by SECOND VICE-PRESIDENT ROBERT EHRHARDT. One application for membership was received. It was announced that a new Ampro Projector had been purchased and paid for.

LIBRARIAN ROBERT HORROCKS presented the speaker for the evening, one of our members, DR. D. G. FOULKE, Hanson-Van Winkle-Munning Company. His subject, "Magnesium Anodizing", was illustrated with stereoptican slides and samples of magnesium metal which had been anodized and analene dyed. Numerous questions followed. Attendance was thirty-nine.

GEORGE WAGNER, *Secretary*

NEWARK BRANCH

Thirty members and guests were present at the regular meeting on May 19,

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which began by the showing of a movie, "This Moving World", sponsored by the Malleable Founder's Society. It depicted the uses of malleable iron in our daily lives.

During the business session, one new member was elected, one resignation was accepted, and one member was reinstated.

ROBERT EHRHARDT, Acting Librarian, introduced MR. J. M. HOSDOWICH, Chief Chemist, United Chromium, Inc. He spoke on the subject, "Scratch Hardness and Abrasion Resistance of Electrodeposited Chromium", supplementing his talk profusely with a number of lantern slides. (See A. E. S. Proceedings for 1949, pp. 103–126.) A discussion period followed, during which many questions were asked and answered.

SAMUEL S. FREY,
Recording Secretary

NEW YORK BRANCH

On April 14, John J. Sterling installed the following officers for the year 1950-1951:

President—GEORGE F. HERRMMAN
First Vice-President—ANGELO AMATOBE
Second Vice-President—ALBERT FUSCO
Secretary-Treasurer—GEORGE SCHORE
Financial Secretary—
IRVING GOLDWASSER
Librarian—DERICK HARTSHORN
Recording Secretary—GRACE ARONSON
Sergeant-at-Arms—LESTER LEVINSON
Board of Managers—WILLIAM J. SCHNEIDER, ALEXANDER N. BRAUN, MILTON NADEL

A double feature was then shown: "Unfinished Rainbows", starring Alan Ladd, and its sequel, "Curiousity Shop", starring John Litel and June Lockhart, both by Aluminum Company of America.

Refreshments were served at the close of the film showing.

GRACE ARONSON,
Recording Secretary

NEW YORK BRANCH

On April 28, MR. ADOLPH BREGMAN addressed the members and their guests on "Practical Methods of Determining Plating Costs". Mr. Bregman, Consulting Engineer and Secretary of the Master Platers' Society, outlined several successful methods as well as some unsuccessful ones, pointing out the fallacies inherent in the latter.

The talk was followed by questions from the audience and answers from Mr. Bregman.

GRACE ARONSON,
Recording Secretary

NEW YORK BRANCH

The members met on May 12 to discuss instructions to the Delegates to the A. E. S. Convention. MR. MILTON NADEL, a member of the Branch, then discussed "Finishing of Magnesium". A film, "This is Magnesium", put out by the Dow Chemical Company, was also shown.

At the meeting on May 26, the regular order of business was suspended in order that more time be available for the speaker of the evening, DR. WALTER R. MEYER of Enthone, Inc. Dr. Meyer's discussion of "Bright Dipping and Chemical Polishing of Metals" was followed by an exhaustive question-and-answer period. The meeting was then adjourned, and refreshments were served.

GRACE ARONSON,
Recording Secretary

PHILADELPHIA BRANCH

The regular May meeting on May 26 had an attendance of thirty-five.

LIBRARIAN ALBERT HIRSCH introduced the speaker, MR. WILLIAM H. JACKSON of The Udylite Corporation, whose topic was "Plating Barrels and Auxiliary Equipment". Mr. Jackson began by distributing prints of typical barrel-plating layouts and then discussed in detail the salient points of the equipment, describing the cleaning, pickling, rinsing, loading, unloading, and plating operations. His talk, which followed closely the material contained in his paper published in the November, 1946 issue of THE MONTHLY REVIEW, was interesting and authoritative.

MR. FREDERICK FULFORTH, Branch member, A. E. S. Past President, and United Chromium representative, gave a short, very practical talk about "Stop-offs". Described were the types and uses of the different materials employed, such as organic solutions (lacquers, etc.), waxes, tapes, plugs of resistant materials (plastics).

On a motion introduced by the Board of Managers, LAVI J. RATHMAN, member since 1912, and EDWARD T. HOMAN, member since 1915, were elected as honorary members of the Branch.

The draft of the Branch By-Laws, as reviewed by the Society's Law Committee, was read in part by Chairman Fulforth of the By-Laws Committee. Time not permitting a complete reading and discussion at this meeting, reading will be continued at the June meeting.

Three door prizes, donated by United Chromium, Inc., were won by three members. One new member was admitted.

I. WM. MARCOVITCH, *Secretary*

SYRACUSE BRANCH

The moving picture film, "Service Unseen", shown through the courtesy of the Carrier Corporation, was the first feature at the meeting on May 15. It was followed by a talk about "Specifications" by MR. CY BOSWORTH of the same company.

Refreshments were served through the courtesy of MR. IVAN HOOK of the J. J. Seifen Company, a member of the Syracuse Branch. Attendance was thirty.

K. S. PARNELL, *Secretary*

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Membership Report of the A. E. S.

Elections

ADELAIDE BRANCH: F. McIntyre, W. E. Minahan
BUFFALO BRANCH: J. Edw. Hanson
CLEVELAND BRANCH: George M. Bacho, Frank M. McDonald
LOS ANGELES BRANCH: Harold I. Boyd, Fred S. Johnson
MELBOURNE BRANCH: C. S. Dalgleish, F. D. Elliott, J. R. Hillhouse, B. Johnston, J. Wilson
MILWAUKEE BRANCH: Alfred J. Kling, Donald H. Schultz
MONTREAL BRANCH: Alfred Oliver
NEWARK BRANCH: Anthony Ciccotelli
PHILADELPHIA BRANCH: Richard M. Walsh
PROVIDENCE-ATTLEBORO BRANCH: John T. Burrell
SYDNEY BRANCH: Keith D. Stewart, Jack C. Weller
SYRACUSE BRANCH: George Cavanaugh, John H. Dowling, George Kushner
TOLEDO BRANCH: D. Binkley Foster, Gilbert F. Norton
MEMBERSHIP-AT-LARGE: J. F. Carland

Reinstatements

NEWARK BRANCH: Gerald Ascione

Transfers

Erwin Sohn from Louisville Branch to Pittsburgh Branch

Resignations

CINCINNATI BRANCH: Harold C. Duggan
DAYTON BRANCH: Darwin H. Huff
LANCASTER BRANCH: Richard E. Field, Norman J. Gebert
LOS ANGELES BRANCH: M. J. Beal, G. J. Extale, R. H. Longacre, W. A. Nairne
LOUISVILLE BRANCH: G. H. Hillebrand, Jr.
NEWARK BRANCH: Kenneth Carson
PHILADELPHIA BRANCH: Charles G. Shute
SYDNEY BRANCH: H. R. Townsend
SYRACUSE BRANCH: C. F. Benner

Suspensions

BRIDGEPORT BRANCH: George W. Herbert
LOS ANGELES BRANCH: Michael Katich
LOUISVILLE BRANCH: E. T. Bischoff, C. R. Bohannon, J. G. Hattemer
SYDNEY BRANCH: M. W. Brown, C. K. Chaffe, C. Gibbs, F. P. Heard, C. G. Hunt, F. Kulmar, E. Merriman, A. W. Nicholson, J. Peterson, G. Potts, T. Rixon, D. Schrader, A. L. Treherne, R. Veetch

Membership Competition

BRANCH	Membership April 1, 1950*	New Members	Net Change in Membership	Per cent Net Change
FIRST GROUP				
GRAND RAPIDS	141	6	+17½	+12.4
CLEVELAND	195	18	+15½	+ 7.9
BOSTON	142	7	+ 9	+ 6.3
DETROIT†	483	23	+23	+ 4.8
TORONTO	124		+ 3	+ 2.4
CHICAGO	372	8	+ 9	+ 2.4
HARTFORD	132	3	+ 2½	+ 1.9
NEW YORK	280	3	+ 4	+ 1.4
PITTSBURGH	142	1	+ 1½	+ 1.1
LOS ANGELES	201	7	+ 2	+ 1.0
MILWAUKEE	124	2	+ 1	+ 0.8
BRIDGEPORT	155	4	.....	.....
WATERBURY	125	...	.....	.....
NEWARK	238	1	− 3	− 1.3
PHILADELPHIA	192	4	− 3	− 1.6
SECOND GROUP				
MONTREAL	68	6	+ 5	+ 7.4
MELBOURNE†	111	7	+ 6½	+ 5.9
CINCINNATI	87	3	+ 4	+ 4.6
ROCHESTER	104	4	+ 4	+ 3.8
ADELAIDE	72	2	+ 2	+ 2.8
INDIANAPOLIS	94	2	+ 2	+ 2.1
BUFFALO	77	1	+ 1	+ 1.3
TWIN CITY	71	...	.....	.....
BALTIMORE-WASH.	85	...	.....	.....
ST. LOUIS	97	2	.....	.....
NEW HAVEN	106	...	− ½	− 0.5
DAYTON	93	...	− 4½	− 4.8
PROV-ATTLEBORO.	112	3	− 8	− 7.1
SYDNEY	109	4	−12	−11.0
SYRACUSE	85	5	−10	−11.8
THIRD GROUP				
COLUMBUS	47	3	+ 4½	+ 9.6
ST. JOSEPH VALLEY	66	6	+ 6	+ 9.1
ALLENTOWN-READING	37	3	+ 3	+ 8.1
TOLEDO	49	2	+ 2	+ 4.1
SPRINGFIELD	51	1	+ 1	+ 2.0
HAMILTON	23	...	.....	.....
WESTERN ONTARIO	23	...	.....	.....
ROCKFORD	64	...	.....	.....
SAN FRANCISCO	66	...	.....	.....
JACKSON-LANSING	57	...	− 1	− 1.8
SAGINAW VALLEY	64	...	− 2	− 3.1
LANCASTER	62	...	− 2½	− 4.0
SOUTHEASTERN†	54	...	− 4	− 7.4
LOUISVILLE	25	...	− 5½	−22.0
OUTSIDE COMPETITION				
AT LARGE	104	13	+12	.....
IN TRANSFER	27	...	− 4	.....
TOTAL A. E. S.	5,236	157	+80	+ 1.6
Active Membership, July 1, 1950			5,322	

*Subject to Correction. †Winners of membership competition in 1949–1950.

Directory of A. E. S. Officers and Research Chairman Branch Secretaries and Research Chairmen

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The International Nickel Co., Inc., Bayonne, N. J.
Secretary.....The Executive Secretary

LOCAL BRANCHES

ADELAIDE, AUSTRALIA meets second Wednesday of each month. Address G.P.O. Box 598E, Adelaide, S. A., Australia.

ALLENTOWN-READING meets third Wednesday of each month in Spurgeon's Hotel, Allentown, Pa. Secretary-Treasurer, James F. Riegel, 425 S. 18th Street, Allentown, Pa. Research Finance Committee Chairman, William R. Pfeiffer Jr., 975 Green St., Allentown, Pa.

BALTIMORE-WASHINGTON meets second Tuesday of October, December, February, and April in Baltimore at the Engineers' Club, and of November, January, March, and May in Washington, D. C., at the Garden House, Dodge Hotel. Secretary, George E. Best, c/o Research Department, Mutual Chemical Company of America, 1348 Block Street, Baltimore 31, Md.

BOSTON mee.s first Thursday of each month in Hotel Statler. Secretary, Dr. George P. Swift, 53 Galen Street, Watertown, 72, Mass. Research Finance Committee Chairman, Eugene P. Carter, c/o United Carr Fastener Corporation, 81 Ames Street, Cambridge, Mass.

BRIDGEPORT meets first and third Friday of each month in Barnum Hotel. Secretary-Treasurer, Joseph G. Sterling, 134 Colony Street, Bridgeport 8, Conn. Research Finance Committee Chairman, Carl Schaefer, c/o Casco Products Corporation, 512 Hancock Avenue, Bridgeport 5, Conn.

BUFFALO meets first Friday of each month in Markeen Hotel. Secretary, T. Joseph Cuerdon, Jr., 263 Stevenson Boulevard, Buffalo 21, N. Y. Research Finance Committee Chairman, B P. Fortrim, 200 Forest Drive, Orchard Park, N. Y.

CHICAGO meets second Friday of each month at 8 P. M. at Western Society of Engineers, 84 E. Randolph Street. Secretary-Treasurer, Paul Glab, 882 N. Paulina Street, Chicago, Ill. Research Finance Committee Chairman, Clyde Kelly, 740 W. Englewood, Chicago 21, Ill.

CINCINNATI meets fourth Wednesday of each month at 8 P. M. in Engineering Society Headquarters, McMillan Street and Woodburn Avenue. Secretary-Treasurer, Charles Wise, c/o The Buckeye Products Company, 7020 Vine Street, Cincinnati 16, Ohio.

CLEVELAND meets first Friday of each month in Cleveland Hotel at 8 P. M. Secretary-Treasurer, Harry Pochapsky, 24961 Euclid Avenue, Euclid 17, Ohio. Research Finance Committee Chairman, E. C. Friedl, c/o duPont Company, 1335 Guardian Building, Cleveland 14, Ohio.

COLUMBUS meets first Friday of each month at 8 P. M. in Battelle Memorial Institute Auditorium. Secretary-Treasurer. Nathan L. Koslin, 2641 Cleveland Avenue, Columbus 11, Ohio.

DAYTON meets first Friday of each month in Engineers Club. Secretary, Richard M. Clinchens, 701 W. Stewart Street, Dayton 8, Ohio. Research Finance Committee Chairman, C. W. Powell, 3112 Princeton Drive, Dayton 6, Ohio.

DETROIT meets first Friday of each month in Hotel Statler. Secretary-Treasurer, Joseph Gurski, 8885 Littlefield, Detroit 28, Mich. Research Finance Committee Chairman, W. B. Knight, c/o Knight Plating Company, 3143 Bellevue Avenue, Detroit 11, Mich.

GRAND RAPIDS meets second Friday of each month at 7:30 P. M. in Rowe Hotel. Secretary, Victor V. Ventoli, 225 Fountain Street, N. E., Grand Rapids, Mich. Research Finance Committee Chairman, John W. Putte, 308 Gladstone Avenue, S. E., Grand Rapids, Mich.

HAMILTON BRANCH. Secretary, G. M. Dalton, c/o Canadian Westinghouse Company, Ltd., Engineering Department, 286 Sanford Avenue, Hamilton, Ontario, Canada.

HARTFORD meets third Monday of each month in Hotel Bond. Secretary, Stanley Platoz, 26 Erwin Place, New Britain, Conn. Research Finance Committee Chairman, Frank W. Smith, 46 Cottage Street, Meriden, Conn.

INDIANAPOLIS meets first Wednesday of each month at Fox Steak House, 1207 Washington Street. Secretary, Howard Phillips, 1024 Shelby Street, Indianapolis 3, Ind.

JACKSON-LANSING meets second Tuesday of each month alternating between Hayes Hotel in Jackson and Porter Hotel in Lansing. Secretary-Treasurer, E. F. Strefling, 1423 Kelsey Avenue, Lansing 10, Mich.

LANCASTER meets second Friday of each month at 8 P. M. In Thaddeus Stevens Industrial School. Secretary-Treasurer, Harry A. Saylor, 40 N. Poplar Street, Elizabethtown, Pa. Research Finance Committee Chairman, Harry Hovis, Lincoln Highway, West Lancaster, Pa.

LOS ANGELES meets second Wednesday of each month at 6:30 P. M. in Rodger Young Auditorium Secretary, G. D.McDonald, Jr., 3114 Purdue Avenue, Los Angeles 34, Calif.

LOUISVILLE meets third Thursday of each month in Room 119, Speed Scientific Building, University of Louisville. Temporary Secretary, Stanley J. Beyer, 1304 Barret, Louisville 4, Ky. Research Finance Committee Chairman, Garland Logsdon, 1519 Central Avenue, Louisville, Ky.

MELBOURNE, AUSTRALIA, meets third Thursday of each month at 8 P. M. in Metallurgy Theatre, Melbourne Technical College, 124 Latrobe Street. Hon. Secretary-Treasurer John J. Dale, c/o Defence Research Laboratories, Maribyrnong, Victoria, Australia.

MILWAUKEE meets first Friday of each month in Red Arrow Club, 774 N. Broadway. Secretary-Treasurer, E. E. Piellusch, 2921 S. 90th Street, West Allis 14, Wis. Research Finance Committee Chairman, James Paulson.

MONTREAL meets first Tuesday of each month in Mount Royal Hotel. Secretary-Treasurer, W. L. Glover, 754 Second Avenue, Verdun, P. Q., Canada. Research Finance Committee Chairman, P. M. Coady, c/o Alloycraft, Ltd., 27 Hillside Avenue, Westmount, Montreal 6, P. Q., Canada.

NEWARK meets first and third Fridays of each month at 8 P. M. in Hotel Robert Treet. Secretary-Treasurer, George Wagner, 1130 S. Long Avenue, Hillside, N. J. Research Finance Committee Chairman, Edwin Bowerman, 166-41 17th Avenue, Whitestone, N. Y.

NEW HAVEN meets second Tuesday of each month alternating between Sterling Chemistry Laboratory, Yale University, and Hotel Taft. Secretary-Treasurer, B. J. Gaffney, 40 Filbert Street, Spring Glen, Hamden 14, Conn. Research Finance Committee Chairman, Dr. H. L. Kellner, c/o Lea Manufacturing Company, 16 Cherry Avenue, Waterbury 86, Conn.

NEW YORK meets second and fourth Fridays of each month in Statler Hotel. Secretary-Treasurer, George Schore, 150 Bennett Avenue, New York 33, N. Y. Research Finance Committee Chairman, George F. Hermann, 52 Chestnut Street, Brooklyn 8, N. Y.

PHILADELPHIA meets fourth Friday of each month in Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Streets. Secretary, I. William Marcovitch, 1434 Lardner Street, Philadelphia 24, Pa. Research Finance Committee Chairman, Al Hirsch, 1945 W. Airdrie Street, Philadelphia 40, Pa.

PITTSBURGH meets second Thursday of each month in the Avon Room of Sheraton Hotel. Secretary, John M. Davidson, Iola Street, R. F. D., Glenshaw, Pa. Research Finance Committee Chairman, R. A. Woofter, 42 Hiland Avenue, Emsworth, Pittsburgh 2, Pa.

PROVIDENCE-ATTLEBORO meets third Monday of each month in Providence-Biltmore Hotel. Secretary, Frank W. Boothroyd, 51 Barber Ave., Apponaug, R. I. Research Finance Committee Chairman, Pierre B. Lonsbury, 78 North Ave., Attleboro, Mass.

ROCHESTER meets third Monday of each month in Ukranian-American Club. Secretary, Walter F. Swanton, Rochester Institute of Technology, Rochester 8, N. Y. Research Finance Committee Chairman, Cecil Thornton, 20 Lafayette Parkway, Rochester, N. Y.

ROCKFORD meets second Monday of each month in Faust Hotel. Secretary, Vern T. Wissen, Spring Creek Road, Rockford, Ill. Research Finance Committee Chairman, Al Overbie, c/o National Lock Company, Rockford, Ill.

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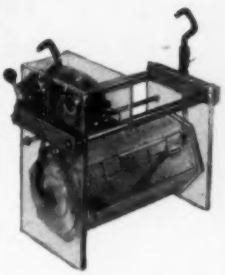

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SAGINAW VALLEY meets for dinner at 7 P. M. and meeting at 8 P. M. at Zenders, Frankenmuth, Mich., second Wednesday of each month, September through May except February. Secretary-Treasurer, Alfred Muehlenbeck, 1411 Beech Street, Saginaw, Mich.

ST. JOSEPH VALLEY meets first Wednesday of each month at 8 P. M. in Hotel Elkhart, Elkhart, Ind. Secretary-Treasurer, Eugene Roth, 1720 Mishawaka Avenue, South Bend 15, Ind. Research Finance Committee Chairman, Victor E. Peterson, 1614 Hickory Street, Niles, Mich.

ST. LOUIS meets second Wednesday of each month in York Hotel. Secretary-Treasurer, E. R. Hunleth, 4415 Michigan Avenue, St. Louis, Mo. Research Finance Committee Chairman, H. Siegel, c/o Siegel-Roberts Plating Company, 4193 Manchester Avenue, St. Louis, Mo.

SAN FRANCISCO meets second Thursday of each month, alternating between El Jardin Restaurant, 22 California Street, San Francisco, and El Curtola Restaurant, 510 17th Street, Oakland. Secretary-Treasurer, Roy Fellom, Jr., 709 Mission Street, San Francisco, Calif.

SOUTHEASTERN meets second Friday of each month in Robert Fulton Hotel, Atlanta, Ga. Secretary, William Weymouth, 173 Clay Street, S. E., Atlanta, Ga. Research Finance Committee Chairman, Dr. Fred W. Cox, Engineering Experiment Station, Georgia School of Technology, Atlanta, Ga.

SPRINGFIELD meets fourth Monday of each month in Hote Charles. Secretary, P. W. Prouty, 69 S. Park Avenue, Longmeadow 6, Mass. Research Finance Committee Chairman, James Laing, c/o Van Valkenburg Company, Montgomery Street, Williamansett, Mass.

SYDNEY, AUSTRALIA. Secretary-Treasurer, H. Coates, Box 1339, G. P. O., Sydney, N. S. W., Australia.

SYRACUSE meets third Monday of each month in Hotel Syracuse. Secretary, Lindley Wood, 1329 Bellevue Avenue, Syracuse 4, N. Y. Research Finance Committee Chairman, George W. Cavanaugh, 129 Kenwood Avenue, Syracuse, N. Y.

TOLEDO meets first Thursday of each month at Commodore Perry Hotel. Secretary, Gaston Bergeman, 703 Pine Street, Fremont, Ohio. Research Finance Committee Chairman, William Russell, 7th Street at Dixie Highway, Perrysburg, Ohio.

TORONTO meets second Friday of each month in Royal York Hotel. Secretary, R. Stevens, c/o Bryden Brass Company, 927 Dufferin Street, Toronto, Canada. Research Finance Committee Chairman, C. D. Short, 1281 Pape Avenue, Toronto, Canada.

TWIN CITY meets first Monday of each month, October through June, in Covered Wagon Cafe, Lodge Room, 114 S. 4th Street, Minneapolis. Secretary-Treasurer, Robert L. Buckley, 316 Builders Exchange, Minneapolis 2, Minn. Research Finance Committee Chairman, Gunnar Deedon, 3650 47th Avenue S., Minneapolis, Minn.

WATERBURY meets second Friday of each month in Elton Hotel. Secretary-Treasurer, Spencer L. Henn, P. O. Box, Dr. B, Cheshire, Conn. Research Finance Committee Chairman, Anthony Maz, c/o Risdon Manufacturing Company, Waterbury, Conn.

WESTERN ONTARIO meets third Friday of each month in William Pitt Hotel, Chatham, Ontario. Secretary-Treasurer, D. E. Paton, c/o Sydenham Trading Company, Ltd., Wallaceburg, Ontario, Canada.

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plating

August 1, 1950

Dear Reader:

In the February issue of this year, we told you that the volume of advertising in PLATING contracted at the beginning of the year was higher than at the start of the previous year.

Now that one-half of 1950 has passed, you may be interested to learn that this early indication has been borne out: actual advertising in PLATING during the period increased by 8.0 per cent.

This compares with a decrease in National industrial advertising of 5.0 per cent.

One cannot but reflect that plating is assuming a larger role in the Nation's economy. No doubt this is due to the forward looking attitude of the plating industry. Better and cheaper methods are continually being developed, and the equipment and supply houses do not hesitate in letting industry know about them.

And PLATING is apparently a good place in which to do it.

Sincerely,

Gustaf Soderberg

Future Meetings

First U. S. International Trade Fair in International Amphitheatre, Coliseum, Navy Pier, and Chicago Arena, Chicago, Ill., on August 7–20.

Industrial Finishes Exhibition at Earle Court, Kensington, London, England on August 30–September 7.

Fifth National Instrument Conference and Exhibit in Memorial Auditorium, Buffalo, N. Y., on September 18–22.

The Electrochemical Society 98th Meeting in Buffalo, N. Y., on October 11–14.

Thirty-eighth National Safety Congress and Exposition of the National Safety Council, Chicago, Ill., on October 16–20.

National Metal Congress and Exposition, American Society for Metals, in International Amphitheatre, Chicago, Ill., on October 23–27.

USE READER SERVICE CARD; INDICATE A 687.

8-1-50

Dear Bill:

Always thought I knew plating but after reading through Lesson 1 of ELECTROPLATING KNOW HOW was my face red! What I like too are those money saving practical tips and ideas you find on almost every page. If anything can be called a gilt edged investment for a plater, E.K.H. is it! Thanks again for recommending me to Joe Kushner of Stroudsburg, Pa.

Sincerely, Jim

USE READER SERVICE CARD; INDICATE A 688.

ROCHELTEX

COPPER ADDITION AGENT
for
UNIFORMITY, ECONOMY, EFFICIENCY

ROCHELTEX is a liquid addition agent which can be added to any cyanide copper plating solution for use in any type of equipment, and is guaranteed to produce uniform results at less cost with less trouble due to the reduction of cyanide additions required and by retarding the carbonate buildup.

★ ROCHELTEX aids in producing brighter, more uniform copper deposits at high current densities — A 20% increase in cathode efficiency is normal with semi-bright lustrous deposits obtained which may be easily buffed or, in many cases, bright nickel plated without buffing. Usually a reduction of 50% of cyanide additions is realized.

★ Nickel deposits over ROCHELTEX copper are brighter and of more uniform color due to the fine, uniform grain size of the copper deposited at all normal current densities.

★ ROCHELTEX is more efficient, yet costs less to use than other addition agents such as Rochelle Salts, due to its low initial cost and additional staying qualities... ROCHELTEX is lost only by dragout and can be easily analyzed by standard analytical methods.

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in the field of *Zinc Die Castings*

Zinc as a metal is not particularly difficult to finish. Being relatively soft, you have to watch out for scoring and dragging, of course, but other than that the problem is usually one of degree. How much should the surface be processed prior to plating and what's the best way of doing it? Remember proper pre-plate finishing can do away with surface defects that plating could not hope to hide.

Lea Technicians can help you on this as they have helped countless others finishing die castings. Authorities on metal finishing by virtue of their more than twenty-five years' constant study of finishing problems, they are in position to make specific suggestions as to the best finish and how to produce it.

We suggest that you send samples of unfinished pieces together with a finished piece or clear description of the finish you want and let our laboratory go to work on your problem. If you would like to first study the problem for yourself send for the "Zinc Die Casting Section of our General Catalog on Finishing."

BURRING, BUFFING AND POLISHING... MANUFACTURERS AND SPECIALISTS IN THE DEVELOPMENT OF PRODUCTION METHODS, EQUIPMENT AND COMPOSITIONS.

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